Submitted to:
US EPA Region 8
Denver, CO

Submitted by:
Atlantic Richfield Company
La Palma, CA
August 3, 2012

Pond 15 Solids Removal Work Plan

Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01
Rico, Colorado

Atlantic Richfield Company

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August 3, 2012

VIA EMAIL AND HAND DELIVERY

Mr. Steven Way
On-Scene Coordinator
Emergency Response Program (8EPR-SA)
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Subject: Pond 15 Solids Removal Work Plan
Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01 Rico, Colorado

Dear Mr. Way,

A digital file in PDF format of the Pond 15 Solids Removal Work Plan, Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, Rico, Colorado dated August 3, 2012, is being submitted to you today via email. Three (3) hard copies of the report will also be hand-delivered to your office on August 6, 2012.

Atlantic Richfield Company (AR) is submitting this report responsive to requirements in Task B – Management of Precipitation Solids in the Upper Settling Ponds / Subtask B2 – Interim Ponds Solids Management of the Remedial Action Work Plan accompanying the Unilateral Administrative Order for Removal Action, Rico-Argentine Site, Dolores County, Colorado, U.S. EPA Region 8, Docket No. CERCLA-08-2011-0005.

If you have any questions or comments, please feel free to contact me at (714) 228-6770 or via email at Anthony.Brown@bp.com.

Sincerely,

Anthony R. Brown

Tony Brown
Project Manager
Atlantic Richfield Company

Enclosure (Pond 15 Solids Removal Work Plan)

cc: Terry Moore, Atlantic Richfield
Sandy Riese, EnSci
Chris Sanchez, AECI
Dave McCarthy, Copper Environmental
Tom Kreutz, AECOM
Doug Yadon, AECOM

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Attachments

1.0 Introduction

AECOM Technical Services, Inc. (AECOM), in cooperation with Anderson Engineering Company, Inc. (AECI) and on behalf of Atlantic Richfield Company (AR), has prepared this Pond 15 Solids Removal Work Plan (Work Plan) to describe the actions that will be implemented at the Rico-Argentine Mine Site - Rico Tunnels Operable Unit (OU01) to remove solids from Pond 15 and convey them to Pond 13 within the St. Louis ponds system. This work is responsive to Subtask B2 of Task B of the Removal Action Work Plan. A review of removal alternatives was prepared to select the optimum removal method. The preferred method is removal of pond solids by suction dredge with storage of solids in an adjacent inactive pond area (Pond 13).

1.1 Scope

The Pond 15 solids removal involves: 1) dike improvements to increase the volume of Pond 13 which will serve as a settling/drying area and temporary solids storage site; 2) implementation of a water management program within the upper St Louis ponds system to direct and control flows from the St. Louis tunnel discharge during the removal operations; and 3) extraction of solids by suction dredging from Pond 15 to improve pond capacity and water freeboard.

Solids have accumulated in the upper ponds of the St. Louis ponds system as a result of precipitation and settling of metals by natural processes and by lime addition to the St. Louis Tunnel discharge from 1984 to 1995. Concerns of high water levels and minimal freeboard of metals impacted water in the St. Louis upper ponds and potential for release of water and flowable solids, led to the need to remove solids from the upper ponds to increase capacities (see the Initial Solids Removal Plan (ISRP) dated May 2, 2011 submitted to EPA by AR). The upper pond volumes are to be increased to provide adequate detention time and space for water and future accumulation of settled solids, and to reduce the potential impacts to the Dolores River in the unanticipated event of an uncontrolled release of the contents of one or more of the upper ponds to the river. Pond 18 solids were excavated in 2011 and placed in an interim drying facility constructed over the inactive Ponds 16/17 area. The scope of the 2012 removal project involves extraction of Pond 15 solids and conveyance to temporary storage in the currently inactive Pond 13. Pond 15 is normally the second active pond in the St. Louis ponds system conveying flows to eventual discharge to the Dolores River at Pond 5. However, Pond 18 is currently offline and flows from the St. Louis Tunnel are temporarily routed directly to Pond 15 via an existing bypass pipeline.

As discussed later in Section 4.3, the solids volume transferred into Pond 13 is expected to reach about 7000 to 8000 cubic yards. An interim internal dike will be constructed within Pond 13 to create a storage area to receive the solids. The storage area is sized at approximately 10,000 cy to accommodate additional free water from the dredging operation. The dike is necessary to keep the slurried solids and associated free water from overtopping the existing Pond 13 dike, and away from the existing Pond 13 outlet structure which cannot be adequately plugged as necessary to prevent escape of the pumped solids and water. As part of this project, a spur dike will be constructed in conjunction with the dike improvements in Pond 13 to serve as a platform for drilling boreholes (described in the Supplement to Field Sampling Plan for Solids Repository, Permanent Drying Facility, and Flood Dike and Pond Embankment Improvements). This spur dike will also serve to improve settling of pumped solids in Pond 13 by creating a more circuitous path and increasing residence time by preventing short-circuiting.

Plan and cross-section drawings showing the anticipated solids removal from Pond 15 and temporary disposal in Pond 13 are presented in Attachment 1.

1.2 Responsibilities

The Pond 15 solids removal and interim storage in Pond 13 will be completed under the direction of Atlantic Richfield Company (AR) per approval of the Environmental Protection Agency (EPA). AECOM will be the responsible Engineer with Anderson Engineering Company, Inc. (AECI) providing technical support and planning for the dredging and water management operations as well as field oversight, management, construction quality control and surveying. Dredge operation, pond dike construction and other construction activities will be provided by a qualified construction contractor to be determined. These roles are summarized as follows:

- Responsible Party – Atlantic Richfield Company (AR)
- Design – AECOM (Engineer)
- Field Oversight/Construction Management/QC – Anderson Engineering Company, Inc. (AECI; Field Manager)
- Survey – Anderson Engineering Company, Inc. (AECI)
- Construction Contractor – TBD
- Dredge Operation Assistance – Pioneer Technical, AMEC

2.0 Objectives

The main objective of this work is to remove solids from Pond 15 and consolidate them to an interim storage facility in Pond 13 as part of the management of precipitated solids responsive to Subtask B2 of Task B of the Removal Action Work Plan and the approved ISRP. The components of this objective of the Pond 15 solids removal described in this work plan are:

- Improve Pond 15 as necessary to facilitate the removal of solids via suction dredging.
- Construct an internal dike and improve existing Pond 13 dikes as necessary to provide the necessary processing and holding volume for removed solids.
- Implement a water management plan for the St. Louis ponds system and the dredging operation during Pond 15 dredging operations.
- Remove Pond 15 solids via suction dredge and transfer these solids via slurry line to Pond 13, leaving a nominal two (2) feet of solids and the underlying existing calcines in Pond 15. The remaining solids are to limit seepage loss to the underlying calcines and predominantly coarse-grained alluvial aquifer.

The design bases and work tasks necessary to achieve these objectives are described in the following sections of this Work Plan.

3.0 Summary of Removal Options

Several solids removal methods were examined for Pond 15. The options were based on methods previously used for solids removal both onsite and at other similar facilities. Other methods of solids extraction were examined that are engaged for channel dredging and wet mine materials removal. The methods included several mechanical removal approaches and removal by floating barge suction dredge.

3.1 Removal by Suction Dredge

A suction dredge operation consisting of an unmanned floating shallow draft barge with a rotating horizontal cutter-head to dislodge solids and a pump system was examined. This type of equipment facilitates removal of wet solids with physical properties of viscous sludge. Barge mounted suction dredges are capable of sludge or sediment removal in water occupied locations and the source areas do not require draining or drying. Suction dredge technology has been successful in removing large quantities of water submerged materials and transporting and accommodating several methods of disposal. Use of suction dredges with cutter-heads has proved a viable method of removal of solids at settling ponds at Atlantic Richfield's Butte Treatment Lagoons (BTL) sediment removal activities in Butte, Montana. The Butte solids removed are generally consistent with the physical properties of the materials located at Rico and of similar depths and quantities.

A FLUMP 4" severe duty 50 horse power pump mounted on a shallow draft barge is the equipment sized for the Pond 15 removal application. The equipment has the capability of pumping up to 900 gpm at approximately 10 to 15 percent solids. The cutter-head is a rotating agitator that aids in breaking and further liquefying the solids for suction into the pump system. Considering the physical properties and consolidation of the solids, a conservatively estimated rate of pumping and solids concentration of approximately 8 percent result in a planned removal that will require approximately 60 days to complete. The dredge operator must exercise care to minimize disturbance of the remaining nominal two (2) feet of solids in order to maintain the liner effect of solids in the pond.

The suction dredge method does not require extensive geotechnical improvements to existing dikes to access the pond that is otherwise required by large excavation equipment. No pumping of pond fluids is needed nor is a drying period for solids. No access causeways are required to reinforce the foundation pad for excavation equipment to enter the pond area for adequate reach to remove solids. Water safety procedures will have to be complied with when working with barge mounted suction dredge equipment. As determined from piezometer and well readings in the Pond 15 area, groundwater levels are within the depth of solids to be removed. The barge mounted dredge is not hindered by this condition as the equipment is floated on water currently in the pond.

3.2 Mechanical Removal by Excavator

This alternative involves the use of conventional earthmoving equipment to excavate solids from the pond. This alternative will involve the following steps:

- Route incoming flow around Pond 15 to the next down-gradient pond in the flow path.
- Decant and pump off remaining surface water from Pond 15 to allow for equipment access and to consolidate existing solids.
- Conduct geotechnical stability analysis with samples collected from the floor of pond 15. Assemble an access plan for causeway construction to facilitate controlled removal of solids.
- Construct multiple causeways for equipment access and reach to excavate pond solids.
- Excavate solids with conventional earthmoving equipment with low ground pressure tracked excavator with extended boom reach and stability swamp pads.
- Haul solids by truck and/or loader to the Pond 13 drying facility.
- Leave approximately two (2) feet of solids undisturbed in the bottom of Pond 15 to limit seepage loss to the underlying predominantly coarse-grained alluvial aquifer.

This is a high production method with 600 to 800 cy per day of removal as experienced with the Pond 18 excavation work. This method is believed to be the most suitable for solids to be excavated above the groundwater table, based on previous pilot scale investigations and removal of Pond 18 solids in 2011 and previously in 2001. As previous mentioned, groundwater levels are within the depth of the solids to be removed. This will require continuous pumping from Pond 15 into the lower series ponds and potentially impacting detention time and solids loading in the system. Additionally, the pond floor is likely not sufficiently stable without reinforcement for safe access with calcine tailings below the pond solids in portions of the pond. The wet calcine tailings are expected to have poor load bearing capability.

3.3 Mechanical Removal by Drag Line

This method would use a crane-type drag line with a large capacity bucket. This method has the potential for high production with removal rates as high as 1000 cy per day of solids that are underwater. Drag lines are commonly used to dredge sediments from channels and small ponds. For removal of Pond 15 solids the equipment would be positioned along the pond dikes and the bucket delivered into the pond solids by cabled rigging and pulled or dragged through the solids. Solids would be collected in the bucket and lifted with the crane out of the pond and dumped in a pile on the dike or adjacent location. The piled solids would then be loaded into trucks or trammed by loader to the Pond 13 drying area. A dragline with the reach to excavate the Pond 15 solids would require a 120,000 lb machine.

This method has several issues for implementation. This size and capacity of drag line needed is not readily available in the four corners states. Also, due to the weight of the equipment, geotechnical stability of the pond embankments would be difficult to maintain with the known equipment loading. Stockpiling of the wet solids would also be difficult due to their tendency to flow and limited space on the dikes for placement. Direct loading of trucks would not be feasible due to narrow dike roads, dike stability and safety concerns. This method was eliminated from further consideration due to the numerous difficulties of implementation.

3.4 Mechanical Removal by Slusher Hoist

Slusher hoist excavation is a process used mainly in underground mining to remove soils and rock or to collect ore. The method uses a small bucket, generally 1/2 cubic yard or smaller guided with cables and pulleys and powered by a drum cable winch. The method allows for excavation of materials that may be submerged underwater. Slusher hoist equipment could be used for Pond 15 solids removal by setting up anchors on the pond embankments to secure the cross cables. The hoist would be positioned and anchored on the dike and the bucket lowered into the submerged solids. In a similar manner to the larger drag line, the bucket would be pulled to collect the solids and the material dumped into a stockpile on the dike or adjacent location. The same problems of stockpiling wet solids, reloading into trucks and geotechnical dike stability/safe access concerns exist for this method as for the dragline. Only one contractor was located in the region capable of the work but was unavailable to complete this work on the required schedule. The method is a low production process. This method was also eliminated from further consideration due to the numerous difficulties of implementation.

3.5 Selected Option – Suction Dredge

The method best suited for the solids removal in Pond 15 with the existing conditions is the barge mounted suction dredge. This method can effectively remove submerged solids from the pond and requires less water management with the elevated groundwater levels. No geotechnical stability issues exist for pond embankments and pond entry as is the circumstance with conventional mechanical excavation equipment. The method has been proven viable for pond solids removal at AR sites in Montana and California. The equipment is also available for usage within the required removal schedule. Water safety concerns do exist for this method and the working around water policies and practices will be followed.

4.0 Pond 15 Solids Removal Work

The Pond 15 solids removal will involve three areas of work: 1) Water Management: the existing St. Louis Adit discharge will be separated into a circuit separate from the Pond 15 dredging / Pond 13 settling circuit to minimize the potential for release of pumped solids. St. Louis discharge water will be managed to maintain detention time for settling existing tunnel effluent as well as providing recirculation and detention for water used in the dredging operation; 2) Pond Access and Dike Improvements: the Pond 15 area will be improved to provide for adequate equipment access; the Pond 13 area will be improved to provide a liquid/solids separation, drying, and temporary storage area and will require embankment upgrades to accommodate the removed Pond 15 solids; and 3) Suction Dredge Solids Removal: an unmanned suction dredge sludge removal system will be used to collect and pump the solids from Pond 15 and transfer them to the Pond 13 facility with recirculation of decanted water back to Pond 15 and/or 18.

4.1 St. Louis Ponds System Water Management

The St. Louis ponds system water management plan will control flows from the St. Louis Tunnel discharge to maintain adequate detention time within the existing pond network during Pond 15 removal activities. As part of the plan, the system will be separated into two circuits: a circuit to continue managing St. Louis Adit discharge, and a circuit to manage the dredging/settling. The water management plan will consist of the following:

- Construction of two (2) flow control gates below the existing DR-3 Parshall flume to direct the flow from the St. Louis Tunnel discharge to Ponds 15 or 18. The location and gates are shown on the Drawings in Attachment 1.
- St. Louis discharge water will normally be directed to Pond 18 during the Pond 15 removal operations. Coupled with the removal of solids in 2011 which expanded the capacity of Pond 18, bringing Pond 18 back online will aid in maintaining detention time for the tunnel discharge water and replace Pond 15 as the first receiving pond during the dredging operation. Pond 18 will be carefully monitored for surface seepage around the perimeter of the dikes to identify any potential stability issues.
- To provide makeup water for dredging and pumping operations and to float the dredge barge, St. Louis water will be directed to Pond 15 as needed from Pond 18 and/or the St. Louis Tunnel or the dredging recirculation line from Pond 13.
- The existing storm water diversion will be maintained for use during Pond 15 removal activities. The diversion channel was design to route run-on from a 25-year return period storm event for the interim drying cell area and Pond 18 removal. This diversion channel will serve to control run-on into Pond 18 and Pond 15 during these work activities.
- A 12-inch gravity feed PVC or HDPE pipeline will be installed from Pond 18 to Pond 14. This pipeline will be used to route water around Pond 15 during dredging operations. The gravity feed pipeline will flow approximately 880 gpm, which addresses the seasonal St. Louis discharge quantity and the flow resulting from a 25-year storm within the pond area. As a back-up system, a 6-inch centrifugal pump and a PVC or HDPE pipeline from Pond 18 to Pond 14 will be available. The pipeline will be fitted with a connection for a back-up pump if needed; however, the backup pump will remain offline to avoid inadvertent over-pressuring of the line. The pump capacity will be up to 850 gpm to accommodate discharge flow and direct rainfall into the pond.
- Discharge outlet pipes from Pond 18 and Pond 15 will be temporally isolated to stop pond flow into and out of Pond 15. This step will serve to isolate Pond 15 during dredging operations and avoid inadvertent transport of slurry fluids into the down gradient settling pond system. Existing emergency spillways from Pond 18 to Pond 15 and from Pond 15 to Pond 13 are not anticipated to be utilized, but will provide emergency backup to prevent uncontrolled overflow of Ponds 18 and 15 resulting from a storm event greater than the design 25-year event during these operations.
- Recirculation of decanted water from Pond 13 back to Pond 15 to maintain dredging operations. Normal Pond 13 level will be maintained via the recirculation pump system and an emergency overflow will be established between Pond 13 and Pond 10 with a minimum 1.0 foot of freeboard between the recirculation intake and the emergency overflow invert.

As Pond 13 begins to fill with settling slurry, the decanted water will be pumped back into Pond 15 to recirculate the water utilized by dredging and to keep disturbed solids in the closed circuit. When recirculation begins and no additional flow is needed into Pond 15, the St. Louis Tunnel discharge water will be directed into Pond 18. When Pond 18 fills to near capacity, the water from Pond 18 will be pumped to Pond 14 to bypass flow into Pond 15. In the event that Pond 13 receives a significant storm event, the emergency overflow of Pond 13 will flow by gravity flow into Pond 10. Pond 10 will be used in this scenario to supplement storage of water and as a potential interim water handling/supplemental detention pond.

Calculations in Attachment 3 estimate that approximately 80 percent of the solids in the slurry are expected to settle out in Pond 13 at maximum production rate. Actual settling will depend on actual production rates as well as the characteristics of the solids themselves. Since the dredge/recirculation circuit is closed, it is not expected that the suspended solids will escape the circuit as long as design storms are not exceeded. However, a sample of Pond 15 solids is currently undergoing jar testing to select a potential flocculent for use in the circuit if it is deemed necessary to increase settling efficiency.

4.2 Pond Access and Dike Improvements

4.2.1 Pond 15 Access Ramp Construction

An access ramp is required to allow an excavator or crane to lower and lift the dredge and barge into and from Pond 15. The ramp will be constructed on the east side of the pond near the northeast corner as shown on the Drawings in Attachment 1. The ramp will have 3H:1V side slopes above and below and a maximum 10 percent grade. The cut and fill are sized to minimize disturbance and eliminate the need to build a foundation into the pond while avoiding disturbance to existing buried pipes in the area. Slope stability runs for the configuration are provided in Attachment 3. Equipment on the ramp is limited to an equivalent to a Caterpillar 330 class excavator utilizing timber mats to distribute ground pressures to 450 psf or less and a light duty truck (GVWR 15,000 pounds or less) to haul the sludge removal barge and trailer.

4.2.2 Dike Access

The Pond 13 dike work areas shown on the Drawings are to be accessed by site existing roads and along embankment (including dike) roads. Access on the dikes shall be developed to accommodate the equipment proposed for completion of the work. Geotechnical stability analyses of the dike, utilizing loading equivalent to a Caterpillar 330 class excavator (the equipment suggested to implement embankment work), were completed for the Interim Flood Dike Upgrades project completed June 2012. Weight distribution timber mats will be required for excavation equipment on the dike. The Drawings in Attachment 1 define embankment modifications and locations to allow for access and completion of the work. All access roads, including roads along the dikes shall be maintained and repaired as needed as part of the dike work. Prior to starting work a utility locate is to be completed by use of Colorado "One Call/Blue Stake" and a second private locator for onsite private utilities on the site.

4.2.3 Existing Pond 13 Dikes

The southern and western dikes within and adjacent to Pond 13 will be improved as identified on the plan view Drawing attached. The improved dike will increase the Pond 13 volume for slurry settling and interim solids management of Pond 15 solids in 2012.

4.2.4 Internal Pond 13 Dike Construction

The internal Pond 13 dike will be constructed over soft sediments (approximately 2 feet of consolidated solids and 3 feet of saturated calcines) and will require specialized construction techniques. The pond dike will be constructed utilizing two layers of high strength, reinforcement-grade geotextile to provide a stable subgrade for the dike fill and equipment loadings as well as to reinforce the dike to provide adequate stability. The geotextile will utilize sewn seams transverse to the axis of the dike to provide maximum reinforcement in the cross-sectional direction. Geotextile will be placed ahead of dike fill and no equipment will be allowed on the geotextile. An initial 12 inches of fill will be placed over the geotextile to support

equipment and protect the geotextile from equipment damage. Construction of the dike will be subject to the following restrictions:

- Only LGP equipment (450 pounds per square foot (psf) or less ground pressure) will be allowed access to the dike for construction of the dike for the first 24 inches of fill. If equipment weight exceeds this requirement, timber mats will be utilized to reduce the loading to 450 psf.
- Only light equipment (1000 psf or less ground pressure) will be allowed access to the full width of dike for construction of the dike after the first 24 inches of fill. If equipment weight exceeds this requirement, timber mats will be utilized to reduce the loading to 1000 psf or less.
- An equivalent H-20 loading (loaded dump truck) will be allowed access to the dike after placement of the first 24 inches of fill provided it maintains at least two feet of clearance from either edge of the crest.

Design computations in Attachment 3 support the selection of this geotextile and demonstrate an adequate factor of safety of 1.3 and 1.5 for during construction and long-term slope stability respectively for the embankment with the anticipated maximum equipment loadings in limit equilibrium slope stability analyses. Also, the calculations demonstrated a bearing capacity factor of safety in excess of 2.1, a foundation squeeze factor of safety of 3.6, adequate resistance to toe squeeze and a factor of safety against failure along the geotextile interface of 4.2. The geotextile has a factor of safety against splitting well in excess of 1.5.

4.2.5 Construction Surveys

Construction surveys will be required to guide the Pond 15 ramp and Pond 13 dike construction. Field staking will be completed utilizing established control monuments from the aerial photogrammetry and topographic base mapping completed in 2011. The field staking will be accomplished to establish the lines and grades required for dike construction. Survey will be completed by AECI in a timely manner to insure compliance with the project schedule. As-Constructed Drawings will be prepared from survey of the built surfaces and surface area limits.

4.3 Suction Dredge Solids Removal

4.3.1 Removal Quantity

A nominal undisturbed, 2-foot continuous layer of solids will be left in place to retard the downward seepage of pond water through the calcine tailings and into the underlying predominantly course-grained alluvium deposits. It is estimated that approximately 4,000 CY of the 11,000 CY solids in Pond 15 will be left in place, thereby requiring approximately 7,000 CY of consolidated material to be pumped into Pond 13.

4.3.2 Operation of the Dredge

An unmanned barge-mounted suction dredge with an agitation head is planned for the solids removal. The dredge system is manufactured by SRS Crisafulli. A traverse system to maneuver and guide the dredge will be constructed, spanning Pond 15 in the shortest dimension. The traverse system will consist of cables complying with manufacturer's requirements for anchoring and weights of the equipment. The traverse system will enable the dredge to move in an east-west direction (shortest length) across the pond and will need to be moved after half the pond is dredged. The J-Series Severe Duty FLUMP, which weighs

approximately 4,500 pounds, will be off-loaded by a crane or loader/excavator rated for a minimum of 6,000 pounds. Per manufacturer's recommendations, four (4) lifting slings of equal length, at least 15 feet in length, will be attached to the four (4) FLUMP lifting eyes with a clevis at each eye. Each of the four (4) lifting slings is attached to the lifting ring of the crane or the hoist. The FLUMP will be raised and positioned over a suitable launch site with at least 18 inches of freestanding water to float the dredge barge. The FLUMP will then be lowered into the water and temporarily secured with at least two anchor stakes using the accessible ramp to be built on the northeast side of Pond 15.

Once in the pond, the dredge will be operated remotely from the shore using a control panel and traverse system. The FLUMP dredge consists of a 50 horse power electric motor to drive the pump and cutter-head. The motor is powered by a 125 kV generator located on the pond bank. Approximately 300 feet of floating discharge line will feed the slurry to the on-shore slurry pipeline. The FLUMP's 7.5-foot horizontal rotating cutter-head will be lowered 12- to 18-inches into the solids while the dredge advances at approximately 3 ft/min. The dredge will traverse the same path along the cable system approximately three passes to remove the solids leaving 2-feet of undisturbed solids lining the pond. The dredge operator must pay special attention to the pond water level, pond contour map, and visual indicators to ensure two (2) feet of solids are left undisturbed to line the pond. The dredge will then be moved sideways approximately eight (8) feet to the next lane and the operation is repeated over the entire area of the pond. The cutter-head only operates during forward movement. The pumping rate should be maintained to prevent solids from clogging the discharge hose at a minimum of approximately 500 gpm. The resulting slurry from the dredge will be pumped through the slurry pipeline into the northwest corner of Pond 13. Once Pond 13 begins to fill, the colloidal water will be recirculated back to Pond 15. The floating recirculation intake will be located in the southeast corner of Pond 13. During the dredging operations, the water/slurry level in Pond 13 will be continuously monitored and pumping will be adjusted when the freeboard is less than 1.5 feet. At the end of each day, water from Pond 15 will be pumped through the slurry pipeline to ensure the slurry does not settle or create any blockages within the slurry pipeline.

4.3.3 Water Safety

The dredge work will be completed in compliance with the BP *Guidance on Practice for Design and Construction Activities Adjacent to or In Water Bodies in Conduct of Remediation of Onshore Decommissioning Activities* and applicable Marine Safety requirements. A Marine Assurance Plan will be assembled that includes the water work scope, location and conditions, marine experts, vessels, inspection, operators and vessel safety. A Water Work and Vessel Emergency Response and Contingency Plan will also be prepared. All employees working with the dredge operation will be trained and competent regarding the use of the equipment and the water safety plans.

4.3.4 Floating Pipe and Other Pipe Works

Up to 300 lineal feet (depending on where the floating pipe connects to the on-shore pipeline) of floating pipe and power insulated conductor cable will be required for the FLUMP to operate over the entire area of Pond 15. Approximately 325 feet (depending on where the floating pipe connects to the on-shore pipeline) of onshore 6-inch pipe will continue the discharge line to the northwest corner of Pond 13.

4.3.6 Recirculation system

A centrifugal pump will recirculate decant water back into Pond 15 at approximately the same rate as the slurry is being placed into Pond 13 (500 to 700 gpm) once a stable pond elevation is reached. Approximately 560 feet of recirculation pipe will be routed from the southeast corner of Pond 13 to the southeast corner of Pond 15 along a step located just below the upstream edge of the dike crest.

4.3.7 St Louis Input Flow to Bypass Pond 15

A 750 gpm minimum capacity centrifugal pump and nominal 6-inch pipeline will be used to transfer water from Pond 18 to Pond 14 to bypass flow around Pond 15. The pipeline will be approximately 460 feet long. This pump and a supplemental pump will accommodate the St. Louis Tunnel discharge inflow and any storm water runoff based on a 25-year return event storm.

4.3.8 Equipment

The dredging operations will require specific equipment to access the site safely and to effectively complete the work. SRS Crisafulli (dredge manufacturer) recommends the 4-inch severe duty FLUMP suction dredge with cutter-head for removal of the solids contained in Pond 15. The equipment can be obtained on a rental basis from SRS Crisafulli and will include:

- 4" FLUMP severe duty suction dredge system
- 300 LF of 6-inch floating discharge line
- Cable traverse system for controlling FLUMP
- SRS Crisafulli representative on site for FLUMP mobilization, equipment set up, and operator training for approximately two (2) days.
- 125 KVA generator to power FLUMP
- Trackhoe excavator or extending crane and four (4) each 15-foot slings to place the FLUMP into and remove dredge from the pond
- 4 to 6 concrete blocks to anchor cable traverse system
- Pump (750 gpm) to recirculate water to Pond 15
- ~560 LF of 6-inch pipe to recirculate colloidal water to Pond 15
- ~325 LF of 6-inch pipe for onshore slurry discharge line
- Pump (750 gpm) to transport water from Pond 18 to Pond 14
- ~460 LF of pipe to pump water from Pond 18 to Pond 14
- Approved boat and rescue skiff for service and water safety requirements

Support shall consist of the following:

- Inspect and ensure stability and safety (including signage) of access roads to the Pond 15 removal and dike improvement areas of Pond 13.
- Delineate the work areas and controlled area required for the project.

- Procure, deliver and stage required equipment, tools, materials and supplies as approved by AECI prior to mobilization. All equipment and materials shall be in good and safe working order and suited for the work to be completed (i.e., tracked excavator and/or extended boom reach excavator, dump trucks, skid-steer, loader, low ground pressure dozer and compactor). A staging area is to be established north of the St. Louis ponds system in the existing fenced secured facility.
- Dredge inspection, initial assembly, and rotation testing will be completed by a competent person prior to launching the dredge. All electrical connections, inspection, and equipment testing will be performed in accordance with the established BTL Lockout/Tagout procedures. Dredge installation and operation will be completed in accordance with manufacturer's instructions.
- Repair of damage done to access roads or surrounding area due to work.
- Demobilization from the site will include all equipment, tools, supplies and unused materials. All trash and debris to be removed for legal disposal and the work site left in a clean and orderly fashion acceptable to AR as determined by AECI.

5.0 Site Security and Safety

The St. Louis ponds system work areas will be secured to control access by the public and unauthorized visitors. The work areas are currently fenced with 4-feet high steel "T" fence posts with two strands of non-barbed wire marked with colored flagging. Warning signs are posted along the fence. The fence will be opened for equipment access to the work and the entries closed during off hours.

Safety concerns identified during preparation of this Work Plan include: weather, uneven terrain, water hazards, and hazardous energy. Required personal protective equipment (PPE) will include work gloves, latex sampling gloves, hardhats, safety glasses, and steel-toed boots. The work will be conducted consistent with the Rico Site Specific Health and Safety Plan. To minimize the potential for harm to personnel, equipment, or the environment, the work will be reviewed and the appropriate Control of Work (CoW) items such as Project and Job Level Work Risk Assessments (WRAs), Daily Toolbox Meeting Records, Task Safety Environmental Assessments (TSEAs), and permits, if any, will be completed, signed, and countersigned, as appropriate, prior to initiating any tasks associated with this work.

Any operations to be performed within six (6) feet of water greater than three (3) feet in depth or that has a soft bottom of sufficient thickness to become an entrapment hazard that can pose a danger of drowning must comply with BP Guidance on Practice for Design and Construction Activities Adjacent to or In Water Bodies in Conduct of Remediation or On-shore Decommissioning Activities dated June 28, 2007. A Marine Assurance Plan and Emergency Response and Contingency Plan for Vessel and Water Safety will be prepared. Personal fall protection and flotation devices (e.g., Coast Guard approved Personal Floatation Device [PFDs] vests or Type IV PFDs such as approved ring life buoys, life rings, or throwing rings equipped with at least 90 feet of retrieval line) will be used. Operations requiring the use of an approved flat bottom boat will also require a mandatory rescue skiff. A trained and competent skiff operator will remain in the immediate vicinity of the rescue skiff at all times while personnel are working on the water.

6.0 As-Constructed Drawings and Construction Documentation

The final constructed dike upgrades will be field surveyed to prepare As-Constructed Drawings. The various upgrade features, ultimate built surfaces, materials and area limits will be captured in the survey. The surveyed data will be reduced and drawings prepared of the accomplished work that depict the improvements. The As-Constructed Drawings will show the work finished in the same format as the design Drawings. The As-Constructed Drawings will be provided in hard copy and electronic format.

Bathymetric (or probe) surveys will be performed pre- and post-removal to document the removal of solids from Pond 15. In addition, the surface of solids deposited in Pond 13 will be laser surveyed upon completion of removal.

All quality control testing required in the specifications will be obtained and reviewed for compliance with technical requirements for each construction component. Ongoing field construction inspections will be documented by written report and photographic documentation at all phases of the construction and will be assembled in the final construction documentation file.

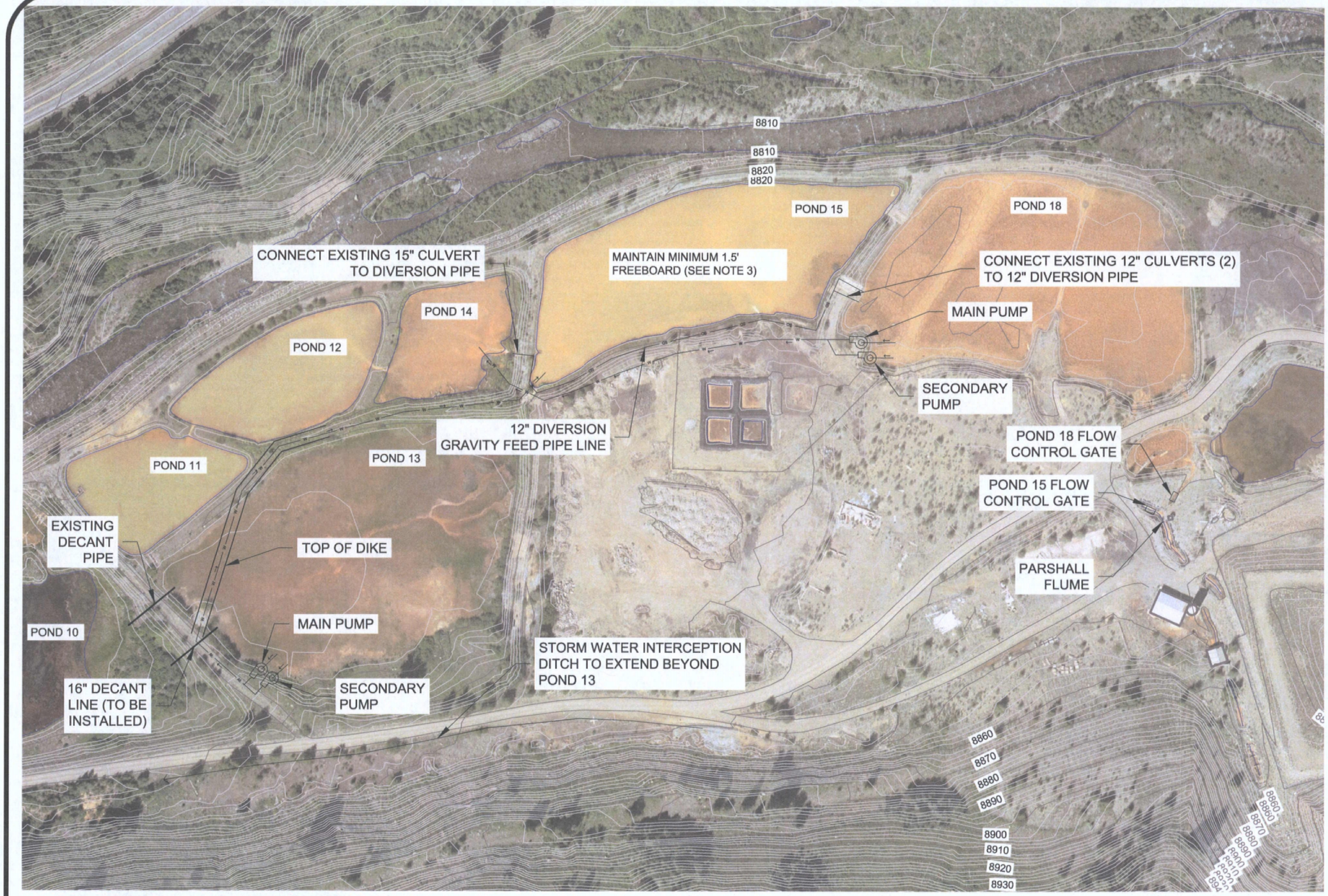
7.0 Schedule

The Pond 15 Solids Removal will be completed on the schedule defined below:

- Materials and Contractor Procurement: 6-21-12 to 7-25-12
- Mobilization: 7-30-12 to 8-8-12
- Work Site Preparation, Storm Water Controls: 8-8-12 to 8-15-12
- Dike Improvements: 8-15-12 to 8-24-12
- Water Management System Set Up: 8-8-12 to 10-24-12
- Dredging: 8-24-12 to 10-24-12
- Demobilization: 10-24-12 to 10-31-12

ATTACHMENT 1

Drawings



01 POND 15 SOLIDS REMOVAL

SCALE - 1" = 120'

General Notes

NOTES:
1. MINUMUM 700 GPM PUMPING CAPACTY NEEDED TO PUMP FROM POND 18
2. MINUMUM 700 GPM PUMPING CAPACITY NEEDED TO PUMP FROM POND 13
3. INSTALL STAFF GAGE IN POND 15 TO CONTINUOUSLY MONITOR WATER LEVEL

SCALE IN FEET
0 60 120

No.	Revision/Issue	Date

BP / ARCO

ANDERSON
ENGINEERING COMPANY, INC.
977 WEST 2100 SOUTH
SALT LAKE CITY, UTAH 84119
(801) 972-5222

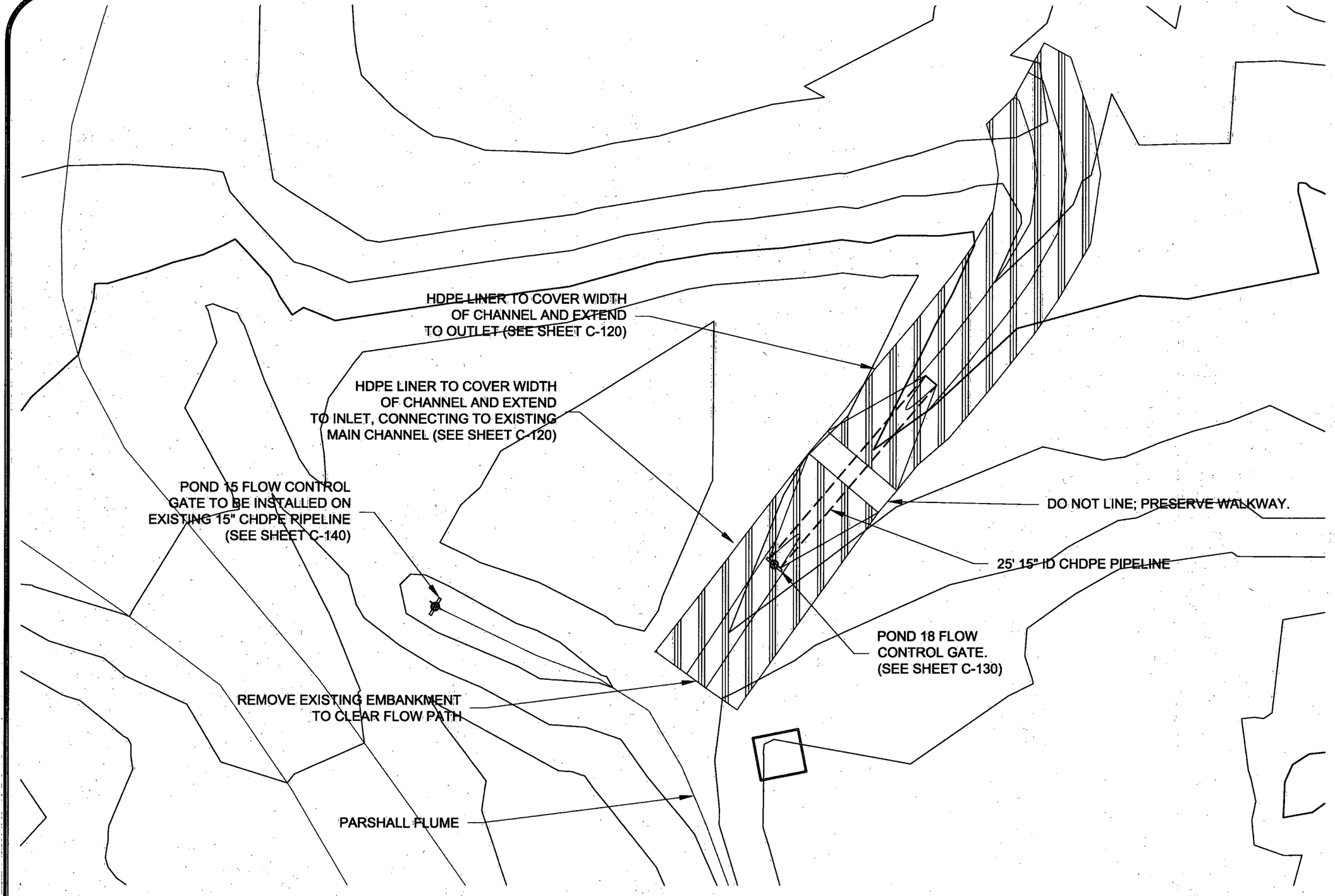
RICO POND 15 SOLIDS REMOVAL

UPPER POND WATER MANAGEMENT

RICO, COLORADO

DRAWN BY:	MAD, CAS
ENGINEER:	MAD, DBJ
APPROVED:	CES

Project	Sheet
Date: 30-Jul-12	C-100
Scale: 1" = 120'	



PLAN VIEW

SCALE - 1" = 10'

General Notes

N

SCALE IN FEET
0 5 10

No.	Revision/Issue	Date

BP

ANDERSON
ENGINEERING COMPANY, INC.
977 WEST 2100 SOUTH
SALT LAKE CITY, UTAH 84119
(801) 679-8222

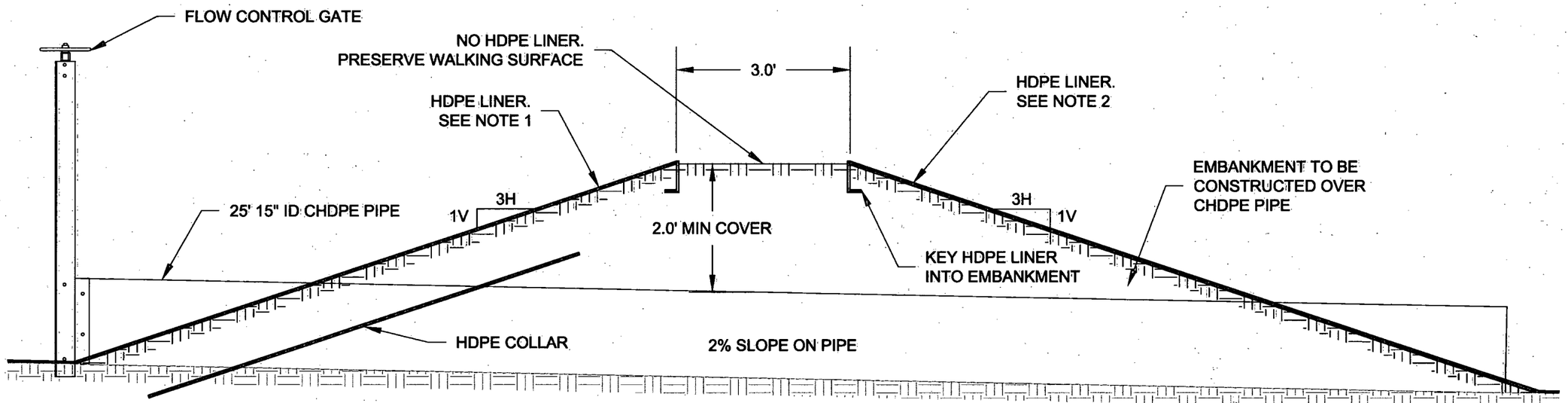
RICO POND 15 SOLIDS REMOVAL

FLOW CONTROL GATE DESIGN - PLAN VIEW

RICO, COLORADO

DRAWN BY:	MAD
ENGINEER:	MAD
APPROVED:	CES

Project	Sheet
Date: 3-Jul-12	C-110
Scale: 1" = 10'	



POND 18 FLOW CONTROL GATE PROFILE VIEW

SCALE - 1" = 2'

General Notes

NOTES:
1. HDPE LINER TO EXTEND SOUTH TO INTERSECT EXISTING CHANNEL (SEE PLAN VIEW).
2. HDPE LINER TO COVER CHANNEL AND EXTEND NORTH TO OUTLET (SEE PLAN VIEW).

SCALE IN FEET
0 0.5 1

No.	Revision/Issue	Date

BP

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ENGINEERING COMPANY, INC.
977 WEST 2100 SOUTH
SALT LAKE CITY, UTAH 84119
(801) 972-6222

RICO POND 15 SOLIDS REMOVAL

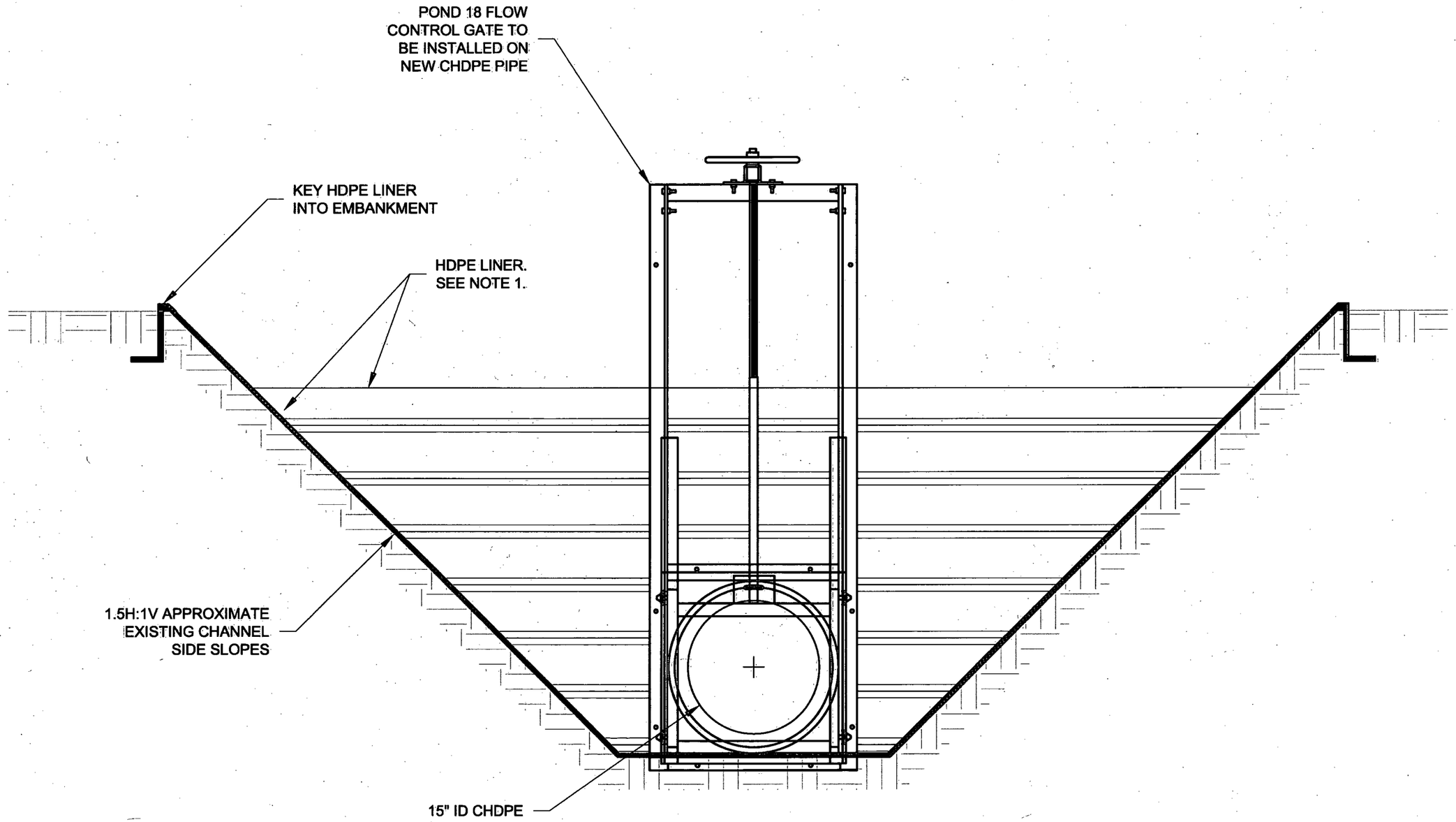
POND 18 FLOW CONTROL GATE, PROFILE VIEW

RICO, COLORADO

DRAWN BY:	MAD
ENGINEER:	MAD
APPROVED:	CES

Project	Sheet: C-120
Date: 3-Jul-12	
Scale: 1" = 2'	

C:\Users\Work\Documents\RICO\2012 work\Pond 15 Dredging\Plans gate options\Plan Control Gate Details.dwg



POND 18 FLOW CONTROL GATE

SCALE - 1" = 1'

General Notes:

NOTES:
1. HDPE LINER TO COVER CHANNEL AND SOUTH FACE OF NEW EMBANKEMNT.

SCALE IN FEET
0 0.5 1

No.	Revision/Issue	Date

BP

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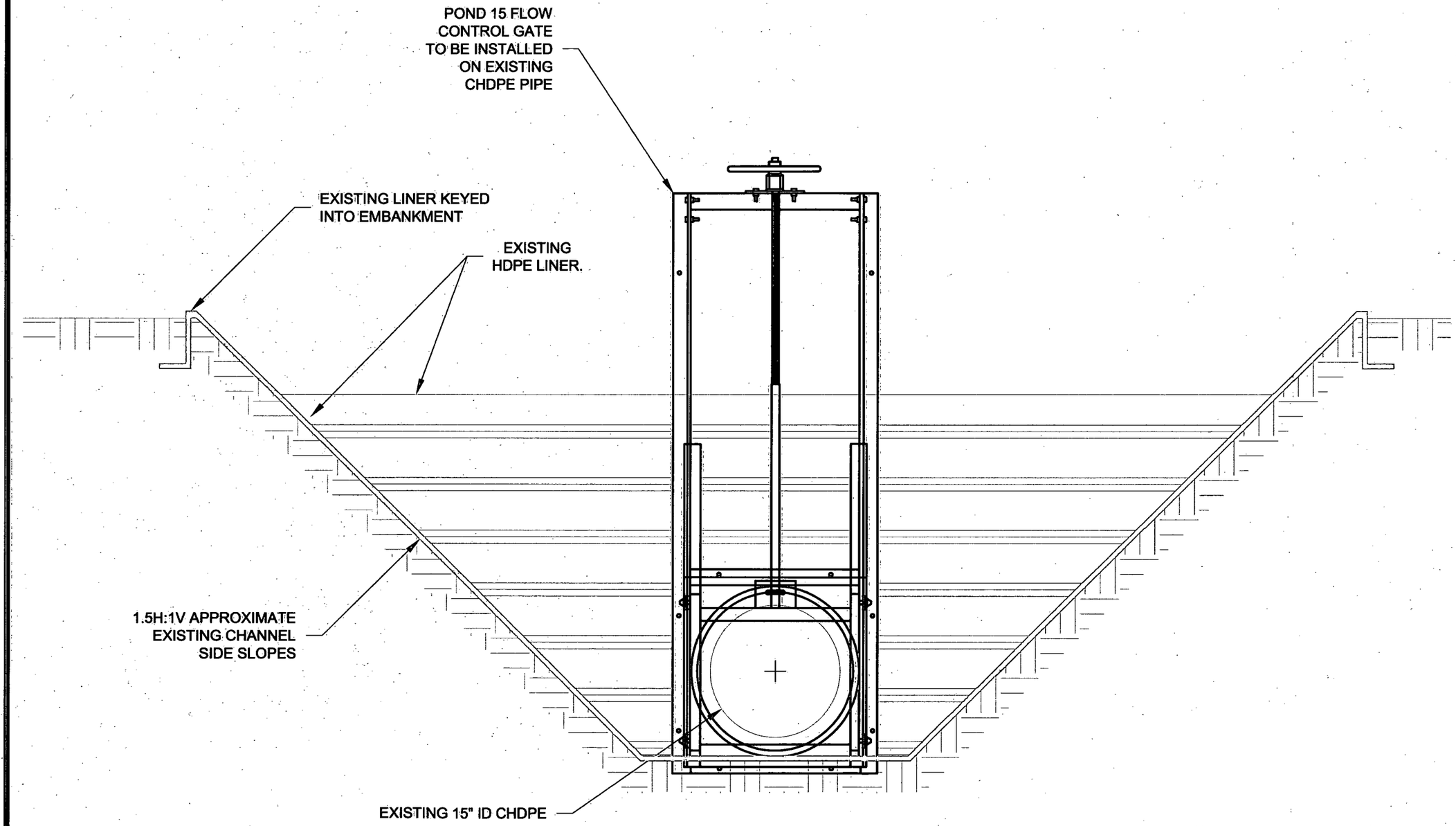
SALT LAKE CITY, UTAH 84119
(801) 972-6222

RICO POND 15 SOLIDS REMOVAL

POND 18 FLOW CONTROL GATE
RICO, COLORADO

DRAWN BY:	MAD
ENGINEER:	MAD
APPROVED:	CES

Project	Sheet
Date: 3-Jul-12	C-130
Scale: 1" = 1'	



POND 15 FLOW CONTROL GATE

SCALE - 1" = 1'

General Notes

SCALE IN FEET
0 0.5 1'

No.	Revision/Issue	Date

BP

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SALT LAKE CITY, UTAH 84119
(801) 972-6222

RICO POND 15 SOLIDS REMOVAL

POND 15 FLOW CONTROL GATE

RICO, COLORADO

DRAWN BY:	MAD
ENGINEER:	MAD
APPROVED:	CES

Project	Sheet
Date 3-Jul-12	C-140
Scale 1" = 1'	

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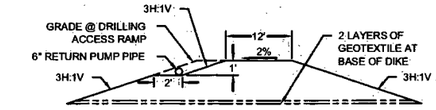
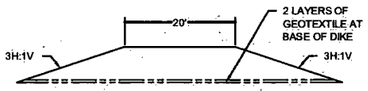
ANSI D 22" x 34"



A SECTION

SCALE: N.T.S.



B SECTION

SCALE: N.T.S.

NOTE:
1. UTILIZE REINFORCEMENT-GRADE GEOTEXTILE ON SUBGRADE BENEATH FOOTPRINT (ASSUMING POND SOLIDS OR CALCINES PRESENT; NOT REQUIRED IF SUBGRADE IS ALLUVIUM).
2. ESTIMATED VOLUME OF SOLIDS TO BE REMOVED FROM POND 15 (LEAVING 2 FEET OF SOLIDS AND CALCINES AND INCLUDING POTENTIAL BULK EXPANSION) IS A MAXIMUM OF 10,000 CY.
3. DO NOT DISTURB EXISTING MONITORING WELLS OR OTHER APPURTENANCES.

LEGEND:
- MONITORING WELL — MW-1
- BOREHOLE / CONE PENETROMETER — PDF-3(CPT)
- TEST PIT — TP2011-04

POND 13 SURVEY BOUNDARY

APPROX. LOCATION EX. _" PIPE (INVERT ~2 FEET ABOVE POND 13 FLOOR)

MW-4

TP-8

OVERFLOW DISCHARGE INTO POND 10

POND 10

TP2011-01

DECANT WATER RECIRCULATION INTAKE
N= 1,387,761.46
E= 2,268,154.46

TP2011-04

RM-5

DH-4

EXISTING DECANT STRUCTURE (NOT IN CONTRACT)

MW-6

POND 13

TOP STACKED SOLIDS ELEV= 8810
ESTIMATED CAPACITY= ±10,000 CY

2' WIDE BENCH ELEV= 8811 FOR RETURN PUMP PIPE

12' WIDE CREST ELEV= 8812 (±1,400 CY FILL)

TP2011-02

ED-4(CPT)

PDF-3(CPT)

DRILLING ACCESS RAMP & PLATFORM

N= 1,388,013.35
E= 2,268,046.64

N= 1,387,842.29
E= 2,268,022.65

204.17'
N18°39'23"E

N= 1,387,894.92
E= 2,268,006.66

EXISTING EMERGENCY OVERFLOW SPILLWAY (NOT IN CONTRACT)

POND 16/17

TP-5

CPT-1

DH-3

TP2011-08

DH-3R

50' TRANSITION FROM 12' WIDTH TO 20' WIDTH

198.51'
S71°20'37"E

CL INTERSECTION= 2+16.59
N= 1,387,819.91
E= 2,267,981.33

POND 15 PUMP SOLIDS DISCHARGE POINT

47.69'
S52°41'51"E

CL PI STA= 2+00.81
N= 1,387,824.96
E= 2,267,966.38

POND 11

MW-1

DH-10

CL PI STA= 1+53.11
N= 1,387,853.75
E= 2,267,928.36

53.11'
S24°21'27"E

POND 12

N= 1,387,902.14
E= 2,267,906.45

POND 13 SURVEY BOUNDARY

POND 14

POND 15

PLAN

1-FT CONTOUR INTERVAL (WITHIN POND 13 SURVEY BOUNDARY, 2-FT OUTSIDE), SCALE: 1"=30'

N

0 30' 60'

SCALE: 1" = 30'

AECOM

PROJECT

RICO-ARGENTINE SITE-OU01

POND 15 SOLIDS REMOVAL WORK PLAN

CLIENT

ATLANTIC RICHFIELD COMPANY

CONSULTANT

AECOM
717 17th STREET
SUITE 2600
303 228 3000 tel 303 228 3001 fax
www.aecom.com

CONSULTANTS

ANDERSON ENGINEERING COMPANY, INC.

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60239818

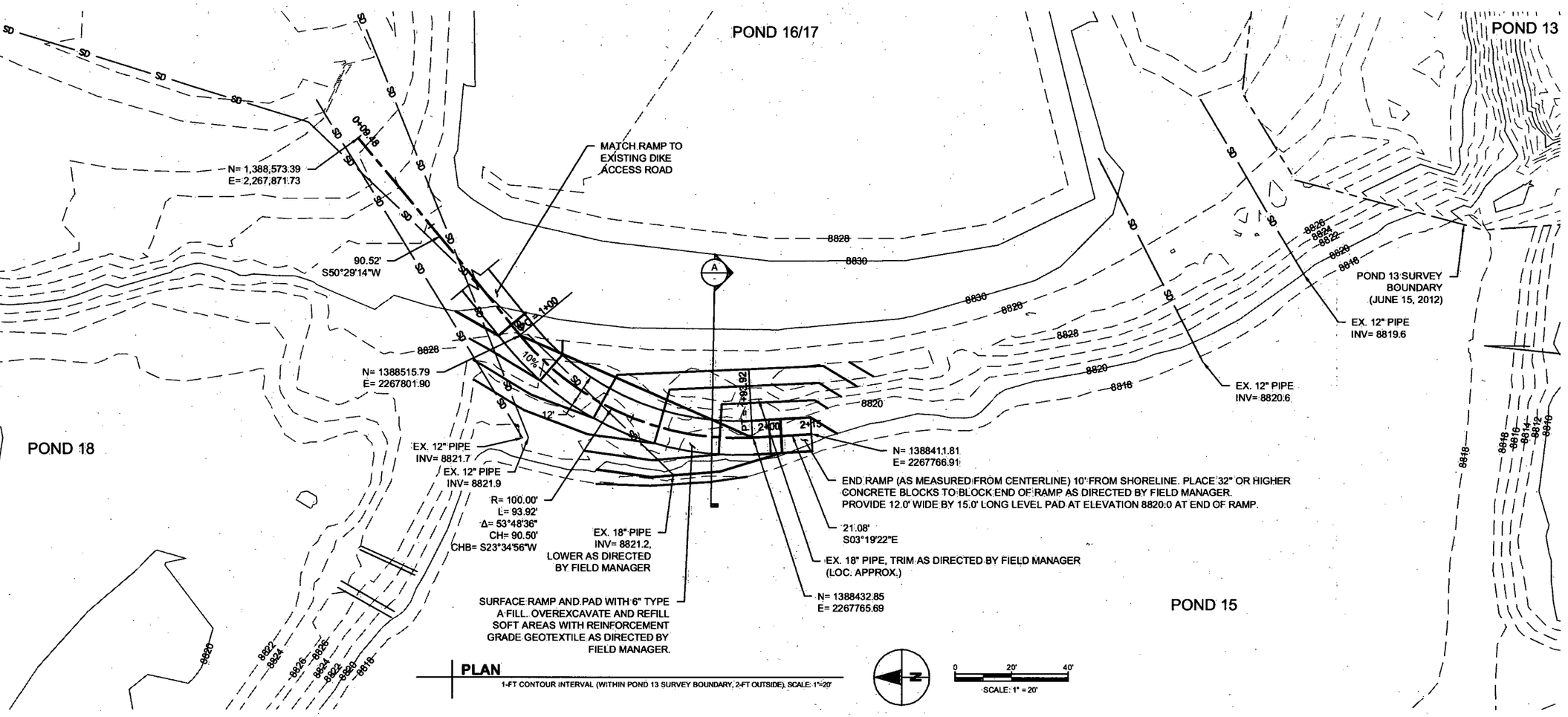
SHEET TITLE

POND 13 INTERIM SOLIDS STORAGE FACILITY

SHEET NUMBER

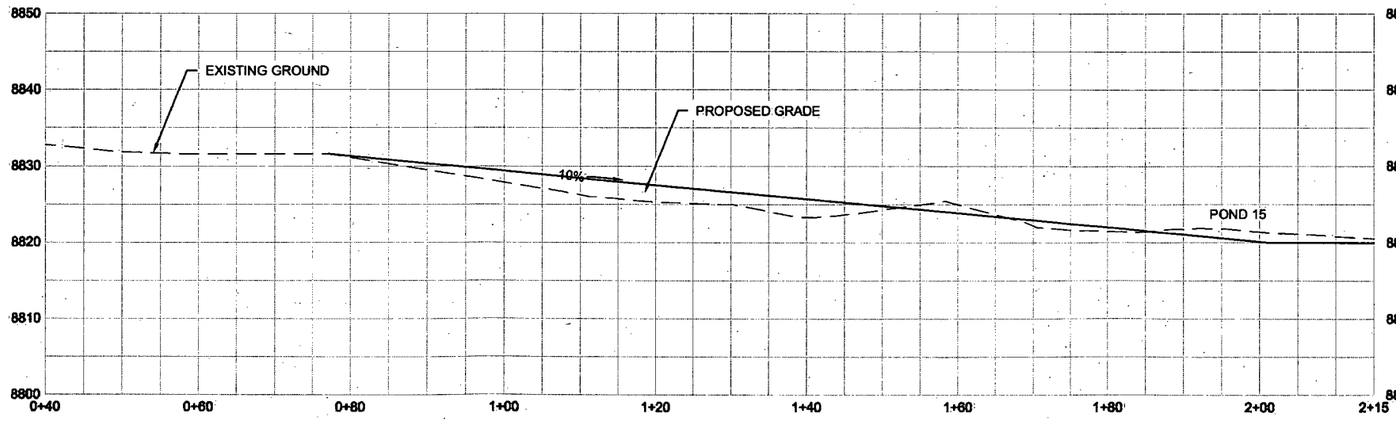
C-200 6 OF 7

ANSI D 22" x 34"



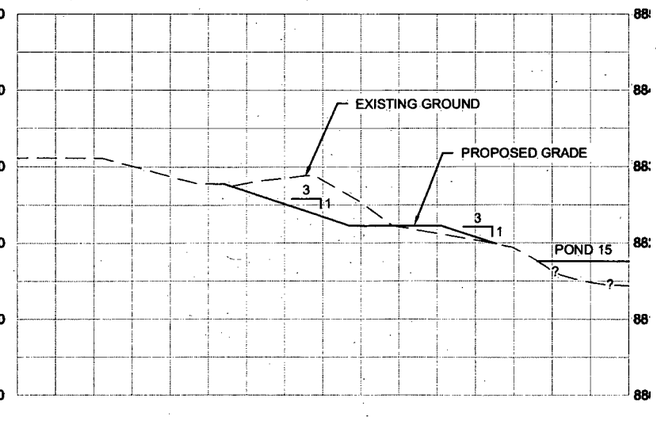
PLAN
1-FT CONTOUR INTERVAL (WITHIN POND 13 SURVEY BOUNDARY, 2-FT OUTSIDE), SCALE: 1"=20'

0 20' 40'
SCALE: 1" = 20'



CENTERLINE PROFILE
SCALE: 1"=10'

0 10' 20'
SCALE: 1" = 10'



A SECTION
SCALE: 1"=10'

0 10' 20'
SCALE: 1" = 10'

AECOM

PROJECT
RICO-ARGENTINE
SITE-OU01

POND 15
SOLIDS REMOVAL
WORK PLAN

CLIENT
ATLANTIC
RICHFIELD
COMPANY

CONSULTANT
AECOM
717 17th STREET
SUITE 2600
303 228 3000 tel 303 228 3001 fax
www.aecom.com

CONSULTANTS
ANDERSON
ENGINEERING
COMPANY, INC.

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER
60239818

SHEET TITLE
POND 15 ACCESS RAMP

SHEET NUMBER
C-300 7 OF 7

ATTACHMENT 2

Technical Specifications

SECTION 01571

ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Requirements for controlling erosion and reducing sediment leaving the construction site and areas under the Contractor's control.

B. Requirements for installing, inspecting, maintaining, and removing temporary erosion control measures.

C. Requirements when an Environmental Control Supervisor (ECS) is included as a bid item in the proposal.

D. Materials and procedures for installing and removing temporary environmental fencing.

1.02 RELATED SECTIONS

A. Section 02376: Erosion Control Blankets/Channel Liners.

1.03 REFERENCES

A. AASHTO M 281: Steel Fence Posts and Assemblies, Hot Wrought B.

B. AASHTO M 288: Geotextile Specifications for Highway Applications.

C. Rico Project Storm Water Pollution Prevention Plan (SWPPP).

D. State of Colorado Storm Water General Permit for Construction Activities, Number COR038415 issued to Atlantic Richfield Company.

E. EPA: National Pollution Discharge Elimination System (NPDES) Best Management Practices

1.04 DEFINITIONS

Not Used.

1.05 SUBMITTALS

A. Prepare and submit a Notice of Intent (NOI) for Storm Water Discharges associated with Construction Activity to the Division of Water Quality at the Colorado Department of Environmental Quality (DEQ) along with a signed copy of the NOI to the Field Manager/Engineer, when disturbing one or more acres. NOI forms can be completed online at Division of Water Quality website. Refer to: http://www.cdphe.wqstorm@state.co.us

1. Submit a Notice of Termination (NOT) form to the Division of Water Quality to terminate the permit, as directed by the Field Manager/Engineer.

B. Submit certification to the Field Manager/Engineer that the Environmental Control Supervisor (ECS) is trained and qualified to complete the requirements of this Specification, the SWPPP and the CO Storm water general permit.

1.06 TYPES

Refer to Drawings and Best Management Practices. Erosion control types listed in this section shall be approved by the Field Manager/Engineer prior to placement.

A. Check Dam:

1. A fiber roll or stone structure placed across a ditch to intercept and trap sediment. Construct so water will flow over a low point in the middle of the dam and not around the sides.

B. Silt Fence:

1. A geotextile fabric fence to intercept and trap sediment.

C. Slope Drain:

1. A polyethylene pipe placed on a slope to collect and transport storm runoff down the face of a slope until permanent drainage facilities are installed or vegetation growth is adequate.

D. Temporary Berm/Channel/Shaped Waterway:

1. A ridge of compacted soil, with or without a shallow ditch that diverts storm runoff from a slope to a controlled release point.

E. Drop inlet Barrier:

1. A fiber roll (wattle), silt fence, or stone barrier placed around a drop inlet that intercepts and traps sediment.

F. Pipe Inlet Barrier:

1. A barrier protecting a pipe inlet that intercepts and traps sediment before it enters the pipe.

G. Curb Inlet Barrier:

1. A protective barrier placed across a curb inlet that intercepts and traps sediment before it enters the inlet.

H. Sediment Trap:

1. An excavated basin, usually installed at low points on a construction site that intercepts and traps sediment. Location determined by the Field Manager/Engineer.

I. Stabilized Construction Entrance:

1. A layer of rock placed at a construction site entrance that removes mud from vehicle tires before tracking onto a paved road.

J. Straw Bale Barrier:

1. Straw bales placed end to end used where a silt fence would fail.

2. Install to intercept and trap sediment.

K. Temporary Environmental Fence:

1. A visual barrier used to delineate and prevent encroachment on sensitive areas.

1.07 ENVIRONMENTAL CONTROL SUPERVISOR (ECS) REQUIREMENTS

(This article applies only when an ECS is included as a bid item in the proposal.)

A. Qualifications:

1. Knowledge of erosion control principles and best management practices for earthwork construction sites.

2. Knowledge of the laws related to environmental clearances and how to obtain the clearances required under Section 01355.

3. Ability to understand and implement environmental plans, details, and specifications.

4. ECS shall be certified by an entity acceptable to the Field Manager/Engineer.

B. Responsibilities:

1. Implementation of environmental protection commitments and proper installation of mitigation measures associated with the project.

2. Maintain environmental compliance.

a. Available 24-hours per day seven days per week to respond as necessary to maintain environmental compliance and to the direction of the Field Manager/Engineer.

3. Obtain environmental clearances in accordance with the SWPPP and the CO Storm water Permit Section 01355 for disturbances, waste sites, staging areas, etc. not specifically provided in the contract.

4. Comply with the requirements of Colorado Storm Water General Permit for Construction Activities – No.: COR038415.

5. Comply with all requirements of U.S. Army Corps of Field Manager/Engineers Nationwide or Individual Permit or Colorado Water Rights, when applicable.

C. Regulatory Agency Coordination:

1. Work with the Field Manager/Engineer to maintain coordination and communication between the Contractor and regulatory agencies. Process all official communication through the Field Manager/Engineer.

2. Coordinate and conduct on-site meetings on an as-needed basis with all regulatory agency inspectors as directed by the Field Manager/Engineer.

3. Notify the Field Manager/Engineer in writing of the results of any agency coordination meeting within 24 hours.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Check dams:

1. Fiber Roll: Contact Field Manager/Engineer for currently approved products.

2. Wood stakes: commercial quality lumber, nominal 2-inch square by 3 ft.

3. Channel Liner: Contact Field Manager/Engineer for currently approved products.

B. Silt Fence:

1. Silt Fence Fabric: See AASHTO M 288 (Table 6 – Temporary Silt Fence Property Requirements).

2. Wood Post: commercial quality lumber, nominal 2-inch square by 4 ft.

3. Fasteners: Staples, wire, zip ties, or nails sufficient to maintain fabric attachment to post.

C. Temporary Berm/Channel/Shaped Waterway:

1. Constructed within existing soil to the size, dimentions and length required by the Field Manager/Engineer.

2. Compaction of soil fill in berms to 95% of maximum dry density (ASTM D 698) +2 % , 13% of optimum moisture. Lifts shall not exceed 6 inches loose placed soil. Testing shall be as directed by the Field Manager/Engineer

3. Channel Armoring: Contact Field Manager/Engineer for currently approved gradation, filters and products.

D. Drop Inlet Barriers:

1. Roll: Contact Field Manager/Engineer for currently approved products and channel construction..

2. Stone: Well-graded within 2 to 6 inch diameter.

3. Silt Fence: See AASHTO M 288 (Table 6 – Temporary Silt Fence Property Requirements).

   a. Wood stud: 2 inches x 4 inches nominal.

E. Pipe Inlet Barrier:

1. Stone: Well-graded within 2 to 6 inch in diameter.

2. Fiber Roll: Contact Field Manager/Engineer for currently approved products.

F. Curb Inlet Barrier:

1. Concrete Building Blocks.

2. Stone: Well-graded within 2 to 6 inch diameter.

3. Wire Mesh: 0.5 inch by 0.5 inch openings.

4. Wood stud: 2 inches x 4 inches nominal.

G. Sediment Trap:

1. Loose Riprap: Contact Field Manager/Engineer for currently approved products.

H. Stabilized Construction Entrance:

1. Stone: Well-graded within 2 to 3 inch in diameter.

I. Straw Bale Barrier:

1. Straw Bales: Obtained from weed free fields that have been certified by the Colorado Department of Agriculture.

J. Temporary Environmental Fence:

1. Fence Fabric a. Polyethylene, high-density, UV stabilized.
2. Width: 4 ft minimum.
3. Color: orange.
4. Posts meet AASHTO M 281.
5. Painted or galvanized metal "T" post, 5 ft to 6 ft long. With safety caps

PART 3 - EXECUTION

3.01 PREPARATION

A. Do not begin any earth-disturbing activity until the NOI form has been completed and submitted to the Water Quality Control Division and the Field Manager/Engineer when disturbing one or more acres.

B. Understand and comply with the requirements of Colorado Storm Water General Permit for Construction Activities.

C. Follow the Storm Water Pollution Prevention Plan (SWPPP).

1. Create and submit a plan to the Field Manager/Engineer if a SWPPP is not currently provided in the Drawings when any earth-disturbing activities are required.

    a. Address all disturbed areas including, but not limited to, staging areas, haul roads, borrow sites, stockpiles, and disposal areas.

    b. Do not start earth-disturbing activity until the SWPPP is approved and project perimeter erosion control measures, and those protecting environmentally sensitive areas, are in place. (1) Obtain written approval from the Field Manager/Engineer to change the SWPPP.

2. Work directly with the Field Manager/Engineer's designated ECS.

    a. Be available as needed to coordinate the SWPPP, inspect and maintain erosion control devices, and resolve other sediment and erosion control issues.

3. Maintain a copy of the approved SWPPP with the following information on the project site at all times:

    a. SWPPP title sheet.

    b. Standard Drawings.

    c. Erosion and sediment control plan sheets.

    d. Project specific details and all contract specifications.

D. Use the most restrictive requirement if a conflict occurs between erosion and sediment control specifications and federal, state, or local agency laws, rules, or regulations.

E. Install temporary environmental fence, when required, before construction begins.

3.02 INSTALLATION

A. The erosion control measures in the SWPPP are illustrative. Adapt measures in the field to meet their intended purpose and implement appropriate erosion control measures necessary as the project progresses. Make required changes to the SWPPP to accommodate construction sequencing with the approval of the Field Manager/Engineer.

B. The Field Manager/Engineer may direct the installation of additional erosion control measures. Install additional erosion control measures as directed.

C. Follow installation procedures outlined in the Standard Drawings.

D. Provide or construct measures such as check dams, silt fence, slope drains, drop inlet barriers, sediment traps, and other erosion control devices or methods to reduce erosion and sedimentation.

E. Install stabilization measures as soon as practical on newly disturbed areas but in no case later than 24 hours after disturbance, unless further construction activity precludes installation and will resume inside that area within 21 days from when activity ceased.

1. Install stabilization measures before seasonal shut down.

F. Install temporary environmental fence in the required locations.

1. Install posts at a 12 ft. maximum spacing so the fence does not sag more than 2 inches between posts.

2. Weave the fence over the support posts alternating every two loops and secure it to the posts with wire or plastic ties.

3.03 INSPECTION

A. Inspect all denuded areas during construction to determine potential erosion problems. Apply corrective measures as required.

B. Inspect erosion control measures, including sediment retention structures, at least once per week upon beginning earth-disturbing activities and within 24 hours after any storm event greater than ½ inch. Conduct inspections at least once per month when construction activities are temporarily or seasonally shut down.

1. Invite the Field Manager/Engineer to inspections.

2. Complete an inspection report after each inspection and submit it to the Field Manager/Engineer within 24 hours of the inspection. Include the following information:

a. Names of personnel attending, and date of the inspection.

b. List of problems identified in the previous inspection and note whether or not corrections have been made.

c. List by location, earth-disturbing activities since previous inspection.

d. List by location, erosion and sediment control measures installed since previous inspection.

e. List by location, new and unresolved problems encountered with specific erosion control measures. Describe solutions to be implemented.

3.04 MAINTENANCE

A. Maintain erosion control devices in order that they function properly until all disturbed areas draining to them are stabilized.

B. Remove and properly dispose of sediment when it has accumulated half way up the overall structure height, or when it interferes with the performance of the structure.

C. Dispose of sediment removed from erosion control structures in a manner acceptable to the Field Manager/Engineer.

3.05 REMOVAL

A. Remove any remaining sediment from behind and around erosion control features and remove all temporary erosion control features unless directed differently by the Field Manager/Engineer after all seeding and mulching has been placed and within two weeks of project acceptance.

B. Remove temporary environmental fence and posts upon completion of construction. 1. Temporary environmental fence and all components become property of the Contractor when construction is complete.

END OF SECTION

SECTION 02076

GEOTEXTILES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Materials and procedures for installing geotextiles of the types shown on the drawings, and at other locations as directed by the Field Manager/Engineer.

1.02 RELATED SECTIONS

A. Section 01571: Environmental Controls.

B. Section 02300: Earthwork.

1.03 REFERENCES

A. AASHTO Standards:

1. M 288: Geotextile Specifications for Highway Applications

B. ASTM Standards:

1. D123 - Standard Terminology Relating to Textiles
2. D276 - Test Method for Identification of Fibers in Textiles
3. D3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics
4. D4354 - Practice for Sampling of Geosynthetics for Testing
5. D4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
6. D4439 - Terminology for Geotextiles
7. D4491 - Test Methods for Water Permeability of Geotextiles by Permittivity
8. D4533 - Test Method for Index Trapezoid Tearing Strength of Geotextiles
9. D4595 - Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip
10. D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles
11. D4751 - Test Method for Determining Apparent Opening Size of a Geotextile
12. D4759 - Practice for Determining the Specification Conformance of Geosynthetics
13. D4873 - Guide for Identification, Storage, and Handling of Geotextiles
14. D6241 - Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. CDOT Standards:

1. Minimum Sampling and Testing Guide

1.04 DEFINITIONS

A. Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.

1.05 SUBMITTALS

A. Manufacturer's certificate that each fabric complies with requirements of this section.

B. Certification: the contractor shall submit a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile. The certification shall state that the furnished geotextile meets marv requirements of the specification as evaluated under the manufacturer's quality control program. The certification shall be attested to by a person having legal authority to bind the manufacturer.

C. Quality standards: the contractor shall provide to the engineer the manufacturer's quality control plan along with their current a2la, gai-lap, and iso 9001:2008 certificates.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

B. The geotextile Manufacturer shall have all of the following credentials:

1. Geosynthetic Accreditation Institute (GAI)- Laboratory Accreditation Program (LAP)

2. American Association for Laboratory Accreditation (A2LA)

3. ISO 9001:2008 Quality Management System

C. The geotextile manufacturer shall have a GAI-LAP accredited laboratory at the location production capable of performing the ASTM tests as outlined in the specification

1.07 SAMPLING AND TESTING

A. Follow Minimum Sampling and Testing Guide requirements as approved by the Field Manager/Engineer.

B. Test each individual lot of geotextile prior to shipment and send testing reports with the shipment to the job site. Clearly label all rolls as part of the same production run and certify they meet all material requirements.

1.08 PACKAGING, SHIPPING, AND STORING

A. Protect the geotextile from direct sunlight, chemicals, mud, dirt and debris during shipment and storage. Replace at the Contractor's sole expense, any geotextile damaged or deteriorated during shipping, storage or construction.

B. Labeling and Tagging:

2. Identify each package by a tag or label securely affixed to the outside of the roll on at least one end.

3. Provide the following required information on the tag:

a. Name of the geotextile manufacturer

b. Brand name of the product, width, length, and package weight of geotextile

1.09 ACCEPTANCE

A. Department rejects geotextile at installation if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transport, handling, or storage.

B. Non-compliance with minimum sampling and testing guide requirements will be a basis for rejection.

1.10 QUALITY CONTROL

A. Manufacturing quality control: testing shall be performed at a laboratory accredited by GAI-LAP and A21A for tests required for the geotextile, at frequency meeting or exceeding ASTM D4354.

B. Sewn seam strength shall be verified based on testing of either conformance samples obtained using procedure a of ASTM D4354, or based on manufacturer's certifications and testing of quality assurance samples obtained using procedure b of ASTM D4354. A lot size for conformance or quality assurance sampling shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

C. Ultraviolet stability shall be verified by an independent laboratory on the geotextile or a geotextile of similar construction and yarn type.

PART 2 - MATERIALS

2.01 SILT FENCE GEOTEXTILE

A. Refer to Section 01571.

2.02 EROSION CONTROL GEOTEXTILE

A. Furnish as specified in AASHTO M 288.

2.03 DRAINAGE GEOTEXTILE

A. Furnish non-woven drainage geotextile as specified in AASHTO M 288 with in-situ soil designations as shown on the drawings or as indicated by the Field Manager/Engineer.

B. Notify Field Manager/Engineer if soil conditions are different than shown on the drawings.

2.04 SEPARATION GEOTEXTILE

A. Furnish Class II fabric as specified in AASHTO M 288, with Apparent Opening Size of 0.22 mm maximum average roll value.

2.05 REINFORCEMENT GRADE GEOTEXTILE

A. The geotextile shall be woven from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters. They shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

B. The geotextile shall meet the requirements of Table 1. All numeric values in table 1 except AOS represent MARV in the specified direction. Values for AOS represent maximum average roll values.

TABLE 1 - SUBGRADE STABILIZATION GEOTEXTILE

Property	**Test Method**	**Units**	**Required Value**	
Reinforcement Properties			MD	CD
Ultimate Tensile Strength	ASTM D4595	lbs/ft (kN/m)	4800 (70)	4800 (70)
Tensile Strength @ 2% Strain	ASTM D4595	lbs/ft (kN/m)	960 (14)	1320 (19.3)

Tensile Strength @ 5% Strain	ASTM D4595	lbs/ft (kN/m)	2400 (35)	2700 (39.4)
Coefficient of Interaction -Ci (sand)	ASTM D5321	--	0.8	
Permittivity	ASTM D4491	sec^{-1}	0.40	
Apparent Opening Size	ASTM D4751	U.S. Sieve (mm)	30 (0.6)	
Sewn Seam Strength[1]	ASTM D4884	lbs/ft (kN/m)	3000 (43.8)	
Survivability Index Values			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	475 (2114)	440 (1958)
Tear Strength	ASTM D4533	lbs (N)	180 (801)	180 (801)
CBR Puncture Strength	ASTM D4833	lbs (N)	2000 (8900)	
Ultraviolet Stability (after 500 hrs)	ASTM D4355	%	80	

[1] When sewn seams are required. Refer to Section 3 - Execution for overlap / seam requirements.

C. Approved reinforcement grade geotextiles are as follows:

1. Mirafi® HP570
2. Other geotextiles demonstrated to meet the requirements herein

2.06 WEED BARRIER GEOTEXTILE

A. Furnish non-woven weed barrier geotextile with elongation less than 50 percent for all weed barrier applications as specified in AASHTO M 288.

2.07 POSTS FOR SILT FENCE

A. Refer to Section 01571.

PART 3 - EXECUTION

3.01 GENERAL

A. Place geotextile on areas that are smooth, and free of projections or depressions. Do not drag the geotextile across the subgrade. Roll geotextile out as smoothly as possible in the direction of vehicle travel.

B. Do not operate construction equipment or traffic directly on geotextile.

C. Cover the geotextile with indicated cover material as soon as possible when placed for construction. Do not leave uncovered for more than five days.

D. Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6 inches thick cover layer, or twice the maximum aggregate size, whichever is thicker. Do not end- dump cover material directly on the geotextile except as a starter course.

E. Limit construction vehicles in size and mass so rutting in the initial layer above the geotextile is not more than 3 inches deep or half the layer thickness, whichever is the lesser. Do not turning vehicles on the first layer.

3.02 INSTALL SILT FENCE GEOTEXTILE

A. Refer to Section 01571.

3.03 INSTALL EROSION CONTROL GEOTEXTILE

A. Install at locations shown on the drawings.

B. Overlap the geotextile a minimum of 2 feet at all longitudinal and transverse joints or sew the geotextile unless otherwise specified. Refer to this Section, article 3.8, Sewing for sewing requirements.

C. Place overlapped geotextile so that the upstream sheet overlaps the downstream sheets.

D. Overlap each sheet over the next downhill sheet for placement on slopes.

E. Anchor the geotextile using key trenches or aprons at the crests and toes of the slope.

F. Usually 18 inches in length may be helpful in securing the geotextile during installation.

G. Repair: Place patch over damaged area and extend 3 ft beyond the perimeter of the tear or damage.

3.04 INSTALL DRAINAGE GEOTEXTILE FOR SUBSURFACE DRAINAGE

A. Excavate trench to size and depth indicated.

B. Cut geotextile to width required and place in trench. Prevent damage to geotextile.

C. Overlap geotextile 12 inches or the full width of the trench, whichever is less, at the top of the trench.

D. Overlap successive sheets of geotextile a minimum of 12 inches in the direction of flow.

E. Place fill beginning with the sheets overlapped above subsequent sheets to hold geotextile in place.

F. Repair any damage to geotextile by placing patches extending 3 feet in all directions beyond the damaged area.

3.05 INSTALL SEPARATION GEOTEXTILE

A. Install for pavement sections or other applications at locations shown on the drawings.

B. Overlap the geotextile a minimum of 1 foot at all longitudinal and trans- verse joints or sew the geotextile unless otherwise specified. Refer to this Section, article 3.8, Sewing for sewing requirements.

C. Repair: Place patch over damaged area and extend 3 feet beyond the perimeter of the tear or damage.

D. Place fill, beginning with the sheets overlapped above subsequent sheets to hold geotextile in place.

E. Use pins 18 inches long to help secure the geotextile during installation.

3.06 INSTALL REINFORCEMENT GRADE GEOTEXTILE

A. Install Reinforcement Grade Geotextile at locations shown on the drawings, or as designated by the Field Manager/Engineer.

B. Sew all joints per manufacturer's recommendations for reinforcement over soft subgrade. Orient all joints transverse to the dike fill. Follow fill placement requirements in Section 02300 for placement of fill over geotextile.

C. On curves, the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock.

D. Prior to covering, the geotextile shall be inspected by the Field Manager/Engineer to ensure that the geotextile has not been damaged during installation. Damaged geotextiles, shall be repaired immediately. Install a patch over damaged area and extend 3 feet beyond the perimeter of the tear or damage and sew patch.

E. The subbase shall be placed by end dumping onto the geotextile from the edge of the geotextile, or over previously placed fill. Sudden braking and sharp turning shall be avoided. Tracked construction equipment should not be operated directly upon the geotextile. A minimum fill soil thickness of 12 inches is required prior to operation of tracked vehicles over the geotextile. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geotextile. Turning of vehicles shall not be permitted on the first lift above the geotextile.

F. If placement of the backfill material causes damage to the geotextile, the damaged area shall be repaired as previously described above. The placement procedure shall then be modified to eliminate further damage from taking place.

END OF SECTION

SECTION 02231
CLEARING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes:

1. Clearing, grubbing, and stripping.

2. Tree and shrub protection and removal.

3. Removal of debris related to clearing, grubbing, and stripping operations.

1.02 SITE CONDITIONS

A. Existing facilities, structures, and utilities are shown in accordance with available surveys and records.

1.03 RELATED SECTIONS

A. Earthwork: 02300.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Existing Shrubbery and Other Vegetative Material: Existing shrubbery and other vegetative material may not be shown on the Drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed, as specified herein.

B. Preservation of Plant Material

1. Within Clearing and Grubbing Limits: Trees shall be removed within limits of the work or to facilitate access in coordination with the Field Manager/Engineer unless otherwise directed.

2. Outside Clearing and Grubbing Limits: Save and protect all plant material beyond the limits of the Work, as shown on the Drawings, from damage resulting from the Work, unless otherwise authorized by the Field Manager/Engineer in writing.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect bench marks, survey control points, monitoring wells and existing structures to remain from damage or displacement.

B. Protect trees and vegetation to remain. Do not cut or injure trees and vegetation outside easement lines and outside designated clearing and trimming areas.

C. Protect all underground utilities and structures that are to remain. If damage occurs, notify the utility owner within the hour.

D. Protect site features to remain from damage by construction equipment and vehicular traffic.

E. Identify waste areas for stockpiling of removed materials.

3.02 CLEARING, GRUBBING, AND STRIPPING LIMITS

A. Clear, grub, and strip the area to receive riprap or fill, including associated access roads, as shown on the Drawings.

3.03 CLEARING:

A. Remove and dispose of off-site:

1. Trees, snags, brush, shrubs, downed timber, decayed wood, and other cleared vegetative growth.

2. Rocks, tiles, lumps of concrete, trash piles, debris, refuse, rubbish, and fencing. Remove all evidence of their presence from the surface.

B. Obey all Federal, State, and local regulations and guidance regarding the cutting and disposal of diseased trees and vegetation.

3.04 GRUBBING

A. Remove and dispose of all stumps, buried logs, matted roots, and organic materials off site or as directed by the Field Manager/Engineer.

B. Roots larger than two inches in diameter shall be removed to a depth of 12 inches; roots two inches in diameter and smaller shall be removed to a depth of six inches. See Earthwork 02300 for additional requirements.

3.05 TREE AND SHRUB REMOVAL

A. Remove trees and shrubs within limits of clearing, grubbing, and stripping areas designated on the Drawings by felling or cutting individual vegetation and grubbing.

3.06 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

A. Do not burn combustible materials. All cleared vegetation, including shrubs, tree trunks, stumps, branches, and roots, shall be disposed of offsite or if allowed, at a location(s) on site identified by the Field Manager/Engineer, and in accordance with local regulations.

3.07 DISPOSAL OF STRIPPINGS

A. All stripped materials not suitable for reuse, as determined by the Field Manager/Engineer, shall be segregated and disposed off-site at a location(s) identified by the Contractor and in accordance with local regulations. For materials removed from the site, the Contractor shall comply with noxious weed requirements.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials, testing, and earthwork for excavations and fills.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Geotextiles: 02075

B. Clearing, Stripping and Grubbing: 02231.

1.03 SUBMITTALS

A. For material, submit six copies of a report from a testing laboratory verifying that the material as delivered to the site meets all of the requirements of this Specification.

B. Submit results of any earthwork testing, whether required or not in this Specification, performed by Contractor to for review.

C. Submit shop drawings or information on existing equipment support mats, if utilized to distribute equipment ground pressure.

1.04 EXISTING INSTRUMENTATION

A. Monitoring Wells. Monitoring wells at the site are shown on the Drawings and shall be protected by the contractor during construction.

1.05 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM C 33 - Standard Specification for Concrete Aggregates.
2. ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.
3. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft2) (600 kN-m/m2).
4. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
5. ASTM D 1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft2) (2,700 kN-m/m2).

6. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

7. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

8. ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

9. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soil.

10. ASTM D 4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

11. ASTM D 4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

12. ASTM D 6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

13. ASTM D 7382 - Standard Test Methods for Determination of Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibratory Hammer.

B. AASHTO

1. Standard Specifications for Highway Bridges, latest edition.

1.06 TESTING

A. An Independent Testing Service will test for compaction at locations and times at the discretion of Field Manager/Engineer.

B. Contractor shall provide access to testing locations and cooperate with the Independent Testing Service during testing by temporarily shutting down construction operations in the vicinity of the testing if requested.

C. Contractor may perform testing at its discretion to control compaction; however, testing performed by the Independent Testing Service and results reviewed by Field Manager/Engineer shall govern.

D. Reference compaction testing (ASTM D1557, D4253, D4254 and/or D7382) other material quality testing shall be performed once per 2500 cy or material change and in-place density testing (ASTM D6938 or equivalent) shall be performed once every 1000 cy placed or as directed by the Field Manager/Engineer.

1.07 DISPOSAL OF EXCESS AND UNSUITABLE MATERIALS

A. Excess excavated or unsuitable material not meeting the requirements of this Specification for use as fill that is generated on-site shall be disposed of on-site as directed.

1.08 MATERIAL AVAILABILITY

A. Sufficient earthwork material to complete the Work may not be available at the site. Secure source of material and permits to complete the project requirements.

PART 2 - MATERIALS

2.01 TYPE A FILL

A. Type A shall be select materials from required excavations or imported fill classifying as GW, GP, GM, GC, SC, or SW per ASTM D 2487 with maximum rock size of 3 inches and free of frozen materials, mine waste, contaminants, organics, trash, debris, and other deleterious substances.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment Load Limits:

1. Pond 15 Ramp: Ground pressures shall not exceed 450 psf for a full-size track hoe working parallel to the axis of the ramp on approved rigid (timber or other) mats that distribute ground pressure. Mats shall be submitted for inspection prior to use. No other equipment shall be permitted on the ramp except for a light duty truck (GVWR 15,000 pounds or less) to haul the sludge removal barge and trailer.

2. Pond 13 Interim Dike (first geotextile layer and initial fill lift): The first lift of the dike over areas of soft subgrade shall be 24 inches maximum thickness. Refer to Section 02075 (Geotextiles) for minimum thickness. Compaction requirements listed in Section 3.03 shall not apply to the first lift. Compact as directed by Field Manager. Limit equipment ground pressures on the initial fill lift. Equipment ground pressures shall not exceed 900 psf for a skid-steer loader working parallel or transverse to the axis of the dike, and 450 psf for a full-size track hoe or low ground pressure dozer. Approved rigid (timber or other) mats that distribute ground pressure of equipment exceeding this requirement may be utilized provided the distributed pressure does not exceed 450 psf (including the weight of the mat). Mats shall be submitted for inspection prior to use.

3. Pond 13 Interim Dike (second geotextile layer and initial fill lift): Refer to Section 02075 (Geotextiles) for minimum thickness. Compaction requirements listed in Section 3.03 apply to the upper 6 inches of the first lift. Limit equipment ground pressures on the initial fill lift. Equipment ground pressures shall not exceed 1000 psf for a full-size track hoe or low ground pressure dozer. Approved rigid (timber or other) mats that distribute ground pressure of equipment exceeding this requirement may be utilized provided the distributed pressure does not exceed 1000 psf

(including the weight of the mat). Mats shall be submitted for inspection prior to use.

4. Pond 13 Existing Dike and Pond 13 Interim Dike above second geotextile layer): Limit equipment ground pressures. Equipment ground pressures shall not exceed 1400 psf for a full-size track hoe or low ground pressure dozer. An AASHTO "Standard Truck" H20 equivalent loading is permitted on the dike provided a minimum 2-foot clearance is maintained from the edge of the crest. Travel on the Pon13 Existing Dike is limited to the portion between the site entrance road and the tie-in to the constructed Pond 13 Interim Dike.

3.02 EXCAVATION

A. Identify and clearly mark Monitoring Wells prior to commencing work and protect from damage.

3.03 PLACING AND COMPACTING

A. After the first lifts over geotextile, place fill in maximum 6-inch loose lifts. Lifts shall be horizontal in all areas except the Pond 15 Ramp. Lifts may be advanced prior to the completion of previous lifts provided there is at least a 40-foot spacing between leading edges.

B. Fill shall be compacted in place as follows:

1. Fill material with greater than 12 percent passing the No. 200 sieve shall be compacted to at least 95 percent of the maximum dry density and within zero (0) to plus two (2) percent and minus three (3) percent of the optimum water content, when tested in accordance with ASTM D 1557.

2. Fill material with less than five (5) percent passing the No. 200 sieve shall be compacted to at least 75 percent of relative density when tested in accordance with ASTM D 4253 and D 4254 and with sufficient water to prevent bulking, or to 95 percent of the maximum density and within the range of water content for effective compaction as determined when tested in accordance with ASTM 7382, at the discretion of the Field Manager/Engineer.

3. Fill material with five (5) to 12 percent passing the No. 200 sieve shall be compacted to either 95 percent of maximum dry density when tested in accordance with ASTM D 1557, or 75 percent of relative density when tested in accordance with ASTM D 4253 and ASTM D 4254, or to 95 percent of the maximum density as determined when tested in accordance with ASTM D 7382, at the discretion of the Field Manager/Engineer; moisture content shall be within zero (0) to plus two (2) percent and minus three (3) percent of optimum water content when compaction is controlled per ASTM D 1557, sufficient to prevent bulking when compaction is controlled by ASTM D 4253 and ASTM D 4254, and within the range for effective compaction as determined when tested in accordance with ASTM 7382.

C. Contractor is responsible for selecting equipment and employing means and methods to achieve the compaction requirements in this section.

D. Materials not meeting the specified moisture content and/or percent compaction shall be reworked until acceptable results are obtained. Reworking may include removal, rehandling, reconditioning, rerolling, or combinations of these procedures.

END OF SECTION

ATTACHMENT 3

Design Computations

4" SEVERE DUTY FLUMP SPECIFICATIONS

DREDGE PERFORMANCE:

Dredge depth	12' (3.66 m) max.
Flow	1000 GPM @ 74' (water) (3785 L/min. @ 22.56 m)
Pressure	102' @ shutoff (31.08 m)
Dredge width	8.5 (2.59 m)
Total weight	3500 pounds (15570 N)

PLATFORM:

Dimensions

Length	18' (5.49 m)
Width	8.5' (2.59 m)
Height	6' (1.83 m)
Flotation	Modular polyethylene floats
Frame	A-36 mild steel modular construction

PUMP:

Size	4" (102 mm)
Type	Centrifugal vertical direct drive
Motor	50 Hp (37.3 Kw),TEFC, 1750 RPM, 230/460 VAC
Length	12' (3.66 m)
Discharge	6" (152 mm) diameter male NPT
Max. spherical solids size	2.25 in. (57 mm)

Material of Construction

Volute	AR-400 abrasion resistant alloy
Impeller	AR-400 abrasion resistant alloy
Impeller shaft	Stress-proof alloy
Pump frame	A-36 mild carbon steel
Shaft coupling	Flexible 3-piece

CONTROL PANEL:

On board enclosure
Radio remote control with the following controls:

- Main pump on/off
- Cutterhead on/off
- Hoist up/down
- Traverse fwd/off/rev
- Traverse fast/slow

HOIST WINCH:

Gear motor

Type	Fixed speed
Gear type	Manual helical bevel gear box
Drive motor	1-1/2 Hp (1.12 Kw), TEFC, 230/460 VAC with brake and hand release, (failsafe)
Output speed	18 RPM
Torque	5120 lb. in. max. (578 Nm)
Cable	3/8" Stainless steel
Line pull	First wrap 3810 lbf (16948 N)

CUTTERHEAD:

Type	Horizontal opposing auger
Width	8.5' (2.59 m)
Depth	15" (381 mm)
Drive motor	Hydraulic high torque gerotor
Support bearing	Water lubricated
Torque	5577 lb. in. max (630 Nm)
Speed	51 RPM Nominal

Material of Construction

Auger	A-36 mild carbon steel
Shroud	A-36 mild carbon steel
Tines	Hardened plow steel

BEARING FRAME:

Type	Oil filled, tandem mechanical seal
Primary seal	Type 2 mechanical, Tungsten carbide silicon carbide seal faces
Secondary seal	Type 21 mechanical, carbon ceramic seal faces
Bearings	Heavy duty, deep groove ball
Oil	Exxon NutoH 68

POWER UNIT:

Type	Electric/Hydraulic
Reservoir capacity	20 gallons (75 L)
Drive motor	7-1/2" Hp (5.6 Kw), 1750 RPM, TEFC, 230/460 VAC
Pressure	2000 PSI (13789 Kpa)
Flow	5.0 GPM (18.9 L/min) @ 1000 PSI Maximum
Hyd. pump	0.7 in^3 (11.5 cc) Gerotor
Coupler	Elastomeric flexible
Oil filter	10 micron element

TRAVERSE WINCH:

Type	Variable speed gear motor
Gear type	Parallel helical bevel gear box
Cable drive	Triple sheave
Drive motor	1-1/2 Hp (1.1 Kw), TEFC, 230/460 VAC
Output speed	Variable with VFD (2 - 10 RPM) (3-18 FPM)
Torque	11500 lb. in (1299 Nm)

PAINTING:

Type	Rustoleum 9100 Series
Color	Gun metal gray

Pond 15 Solids removal via dredge required detention time (no flocculent)

Ferguson, R. I., and M. Church (2006), A Simple Universal Equation for Grain Settling Velocity, Journal of Sedimentary Research, 74(6) 933-937, doi: 10.1306/051204740933

Target Particle Size	0.0030	mm
	0.000003	Meters
Pumping Rate	900	gpm
	2.008929	cfs
Op time	9	hr/day
	65089.29	cf/day w/ shutdown overnight
Pond 15 Size	80	ft width
	390	ft length
	4	ft depth
	124800	cf
	0.7	ac
Residence time	1.9	day
	46	hours
Settling Velocity	8.08E-06	m/s
	2.65E-05	ft/s
Settling time	150988	sec
	42	hours

Assumptions

Uniformly distributed flow in detention pond

0.006 mm = 70% removal (based on solids gradation)

0.003 mm = 80% removal

Conservatively does not account for increased settling due to pond seepage, which increases residence time

4 Residence - Settling time (hrs) (must be zero or positive)

Rico Colorado Pond 15 Dredging, Dead Man Anchor Calculation Brief

Purpose

The purpose of these calculations is to show the allowable tensile force in the cable work associated with the Pond 15 dredging operations at the St. Louis Pond at Rico, Colorado. These forces should not exceed the sliding friction force holding the dead man anchor blocks on the ground. This dredging operation is scheduled to commence in July of 2012.

Methods

Using the principals of statics and free-body diagrams, the ultimate tensile forces in the anchor cables are calculated for a range of different loading angles. Two 32"x32"x64" concrete blocks are being used for the dead man calculations, stacked vertically. A static coefficient of friction of 0.3 is utilized for the interface between the bottom of the block and the ground surface. It is assumed that the ground surface is clear of snow and ice, and is dry and free of large debris that would prevent a continuous contact with the ground. The calculations assume that the block will be placed parallel with the tensile force of the cable.

Results

The allowable tensile forces in the main tension cable are related to the angle of the lateral cable in relation to the direct line of site between two anchors. Due to the topography around Pond 15, it may be necessary to place the anchor blocks at an elevation higher than the dredge. For this reason, calculations for two scenarios were run. The first scenario is the horizontal angle calculations, show in the plan view on the calculation page. The second is an elevation view illustrating the anchor blocks on an elevated surface, as shown in the elevation view on the calculation page. The following are two tables of the tension on the main tension cable relative to a range of angles.

Table 1. Horizontal Tensile Forces

θ (degrees)	F_{TY} (lb)	F_2 (lb)
5	282.4	564.8
10	562.6	1125.2
15	838.6	1677.1
20	1108.1	2216.3
25	1369.3	2738.6
30	1620.0	3240.0
35	1858.4	3716.8
40	2082.6	4165.3
45	2291.0	4582.1

Table 2. Vertical Tensile Forces

θ (degrees)	F_{TX} (lb)
5	3252.4
10	3290.0
15	3354.3
20	3447.9
25	3574.9
30	3741.2
35	3955.3
40	4229.5
45	4582.1

The maximum line pull for the hoist winch is 3810 lb force (first wrap). This implies that the ideal horizontal angle is 40 degrees, and the ideal vertical angle is 35 degrees. This ideal angle is the angle at which the hoist winch will exceed its maximum pulling force before the blocks begin sliding. However, it is unlikely that maximum force will be reached. It is recommended that a minimum of 15 degrees be maintained for the vertical angle and for the horizontal angle when the tension triangle is centered between the two anchors.

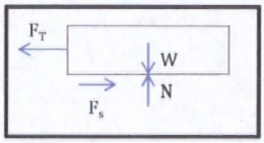
Conclusion

The results presented above are based on calculations for the worst case scenario (the solids in Pond 15 become so difficult to move through that the maximum hoist winch force is being utilized to move the dredge). In such a scenario, two 32"x32"64" (or a setup of different blocks with an equivalent weight) would be necessary if it was desired that no block movement should occur. However, based on observed conditions in the pond and known physical properties of the solids, the resistance will not become so great as to require the full pulling force capacity of the hoist winch to move the dredge. It will very likely be significantly less.

Recommendations: It is recommended that only one 32"x32"x64" block (or a setup of different blocks with an equivalent weight) for each dead man anchor be used. A small depression should be created at each anchor point in the ground surface to set the block in, creating additional resistance. This is in accordance with recommendations made by Eric Lillberg of SRS Crisafulli, the provider of the dredge. Using one block instead of two will reduce the results presented in Table 1 and Table 2 by exactly half.

Rico, Colorado Pond 15 Dredge Dead Man Anchor Calculations:

Ultimate force for sliding friction at barrier

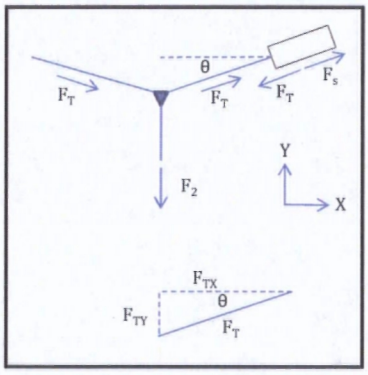


W = Weight of barrier
F_s = Static force of friction
F_T = Ultimate tensile force
μ = Coefficient of static friction
N = Normal force

W = N = 10,800 lb (Two 32"x32"x64" concrete blocks @ 5,700 lb each, stacked)
$F_T = F_s$
$F_s = \mu W = (0.3)(10{,}800\text{lb})$ = **3240 lb**

Ultimate tensile force in cable

Plan View



F_s = Static force of friction
F_T = Ultimate tensile force
F_2 = Line pull force from winch hoist
F_{TX} = Cable tension force parallel to line pull force
F_{TY} = Cable tension force perpendicular to line pull force
θ = Angle from lateral cable to line of sight between dean man anchors

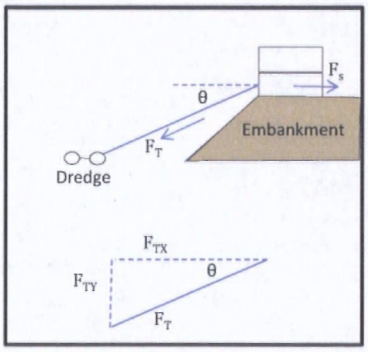
$F_T = 2F_{TY}$
$\sin\theta = F_{TY}/F_T$

$F_{TY} = F_T \sin\theta$, where F_T = 3,240 lb

Note: Max line pull on hoist winch is 3810 lb (first wrap)

θ (degrees)	F_{TY} (lb)	F_2 (lb)	
5	282.4	564.8	
10	562.6	1125.2	
15	838.6	1677.1	
20	1108.1	2216.3	
25	1369.3	2738.6	
30	1620.0	3240.0	
35	1858.4	3716.8	
40	2082.6	4165.3	<--Ideal Angle
45	2291.0	4582.1	

Elevation View



F_s = Static force of friction
F_T = Ultimate tensile force
F_{TX} = Cable tension force parallel to line pull force
F_{TY} = Cable tension force perpendicular to line pull force
θ = Angle from lateral cable to line of sight between dean man anchors

$F_S = F_{TX}$
$\cos\theta = F_{TX}/F_T$

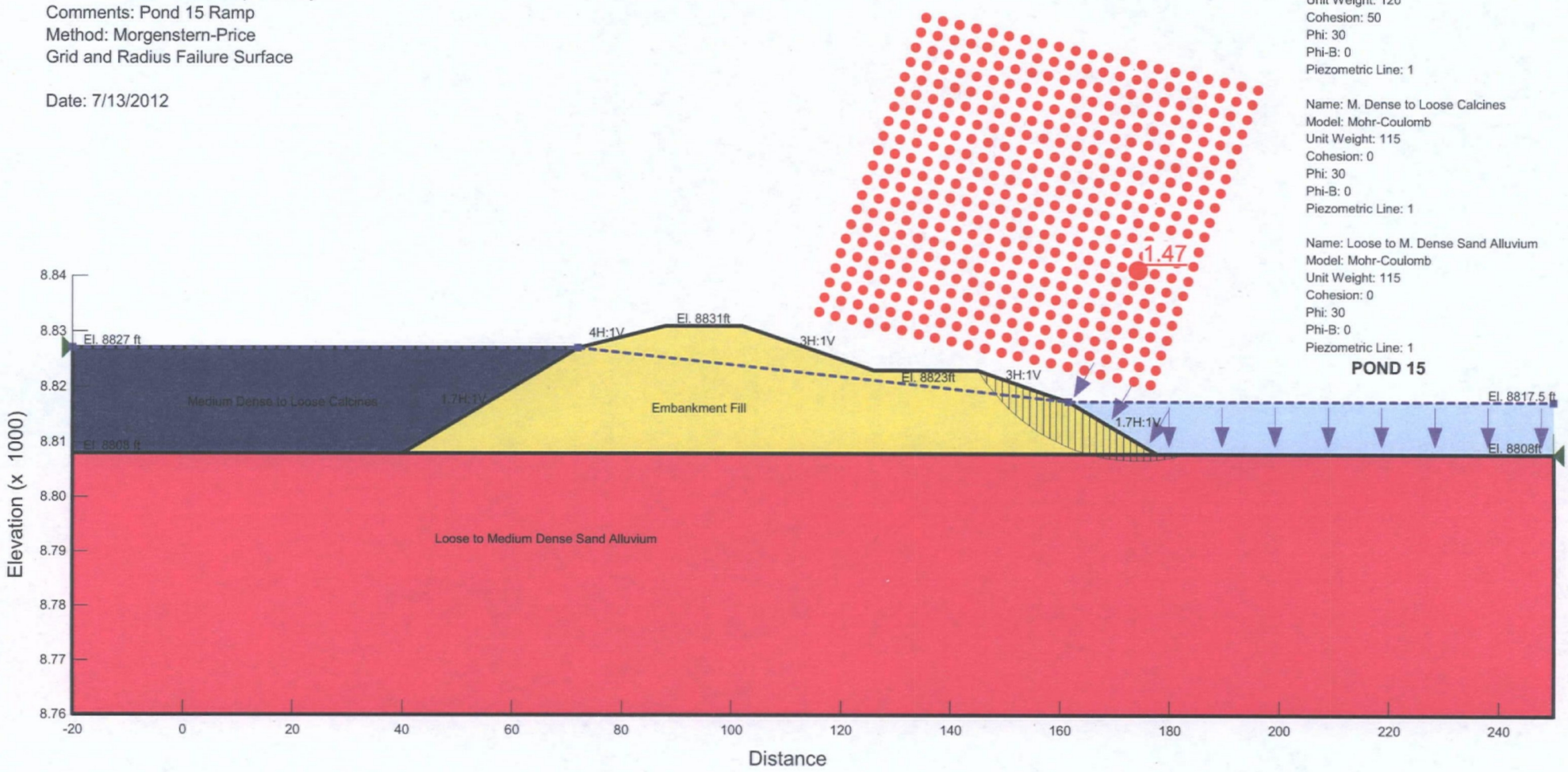
$F_{TX} = F_T \cos\theta$, where F_T = 3,240 lb

Note: Max line pull on hoist winch is

θ (degrees)	F_{TX} (lb)	
5	3252.4	
10	3290.0	
15	3354.3	
20	3447.9	
25	3574.9	
30	3741.2	
35	3955.3	<--Ideal Angle
40	4229.5	
45	4582.1	

Title: RICO Pond 15 Ramp Stability
Comments: Pond 15 Ramp
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/13/2012



Model: Mohr-Coulomb
Unit Weight: 120
Cohesion: 50
Phi: 30
Phi-B: 0
Piezometric Line: 1

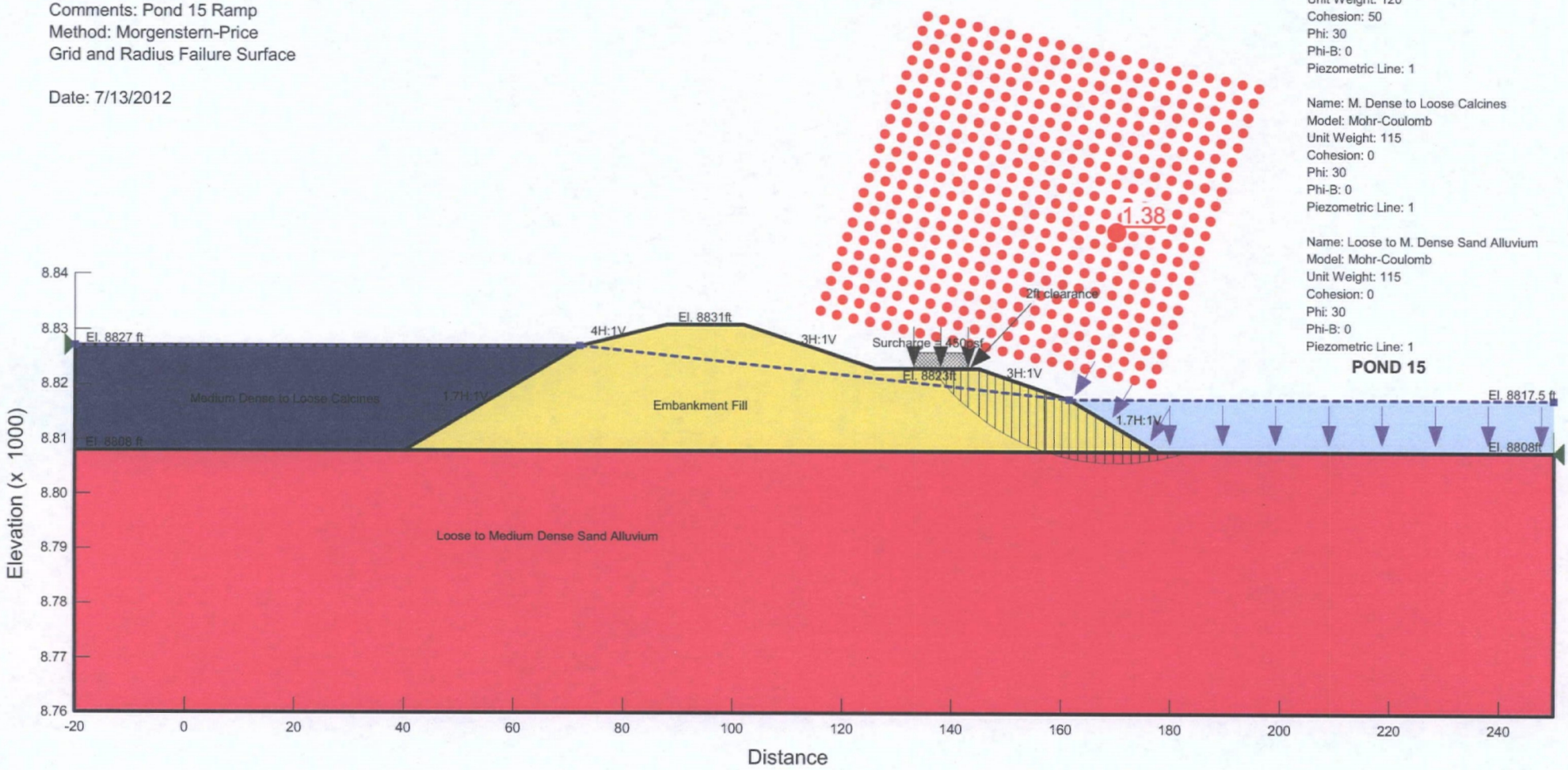
Name: M. Dense to Loose Calcines
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Name: Loose to M. Dense Sand Alluvium
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

POND 15

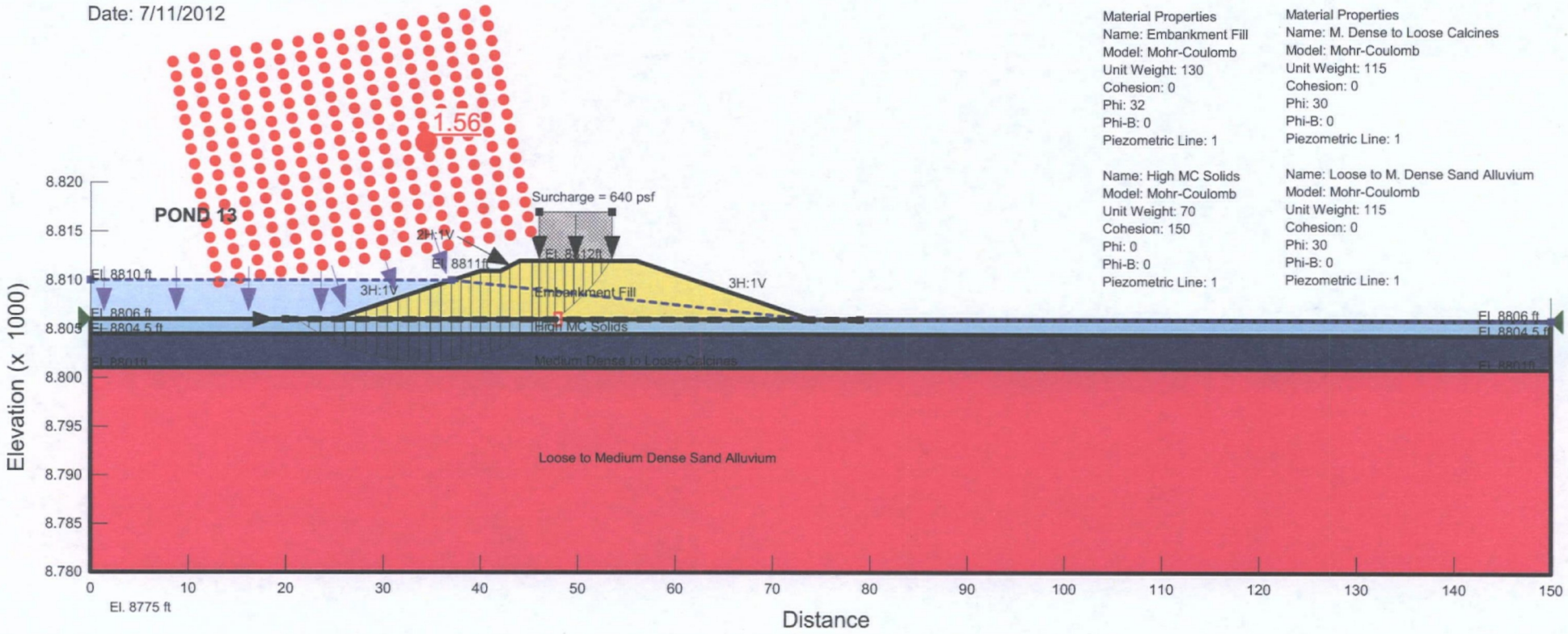
Title: RICO Pond 15 Ramp Stability
Comments: Pond 15 Ramp
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/13/2012



Title: RICO Pond 13 New Dike Stability
Comments: Pond 13
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/11/2012



Material Properties
Name: Embankment Fill
Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 32
Phi-B: 0
Piezometric Line: 1

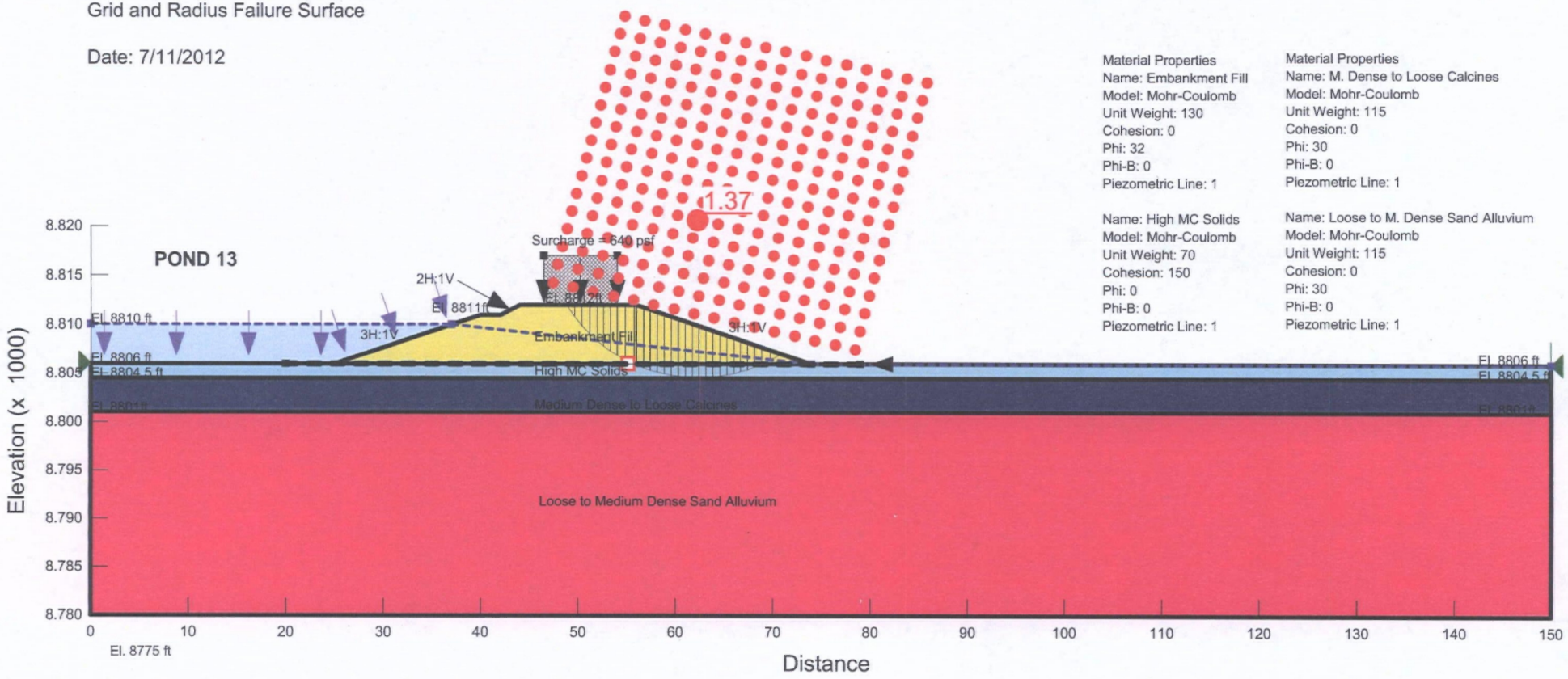
Material Properties
Name: M. Dense to Loose Calcines
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Name: High MC Solids
Model: Mohr-Coulomb
Unit Weight: 70
Cohesion: 150
Phi: 0
Phi-B: 0
Piezometric Line: 1

Name: Loose to M. Dense Sand Alluvium
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Title: RICO Pond 13 New Dike Stability
Comments: Pond 13
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/11/2012



Material Properties
Name: Embankment Fill
Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 32
Phi-B: 0
Piezometric Line: 1

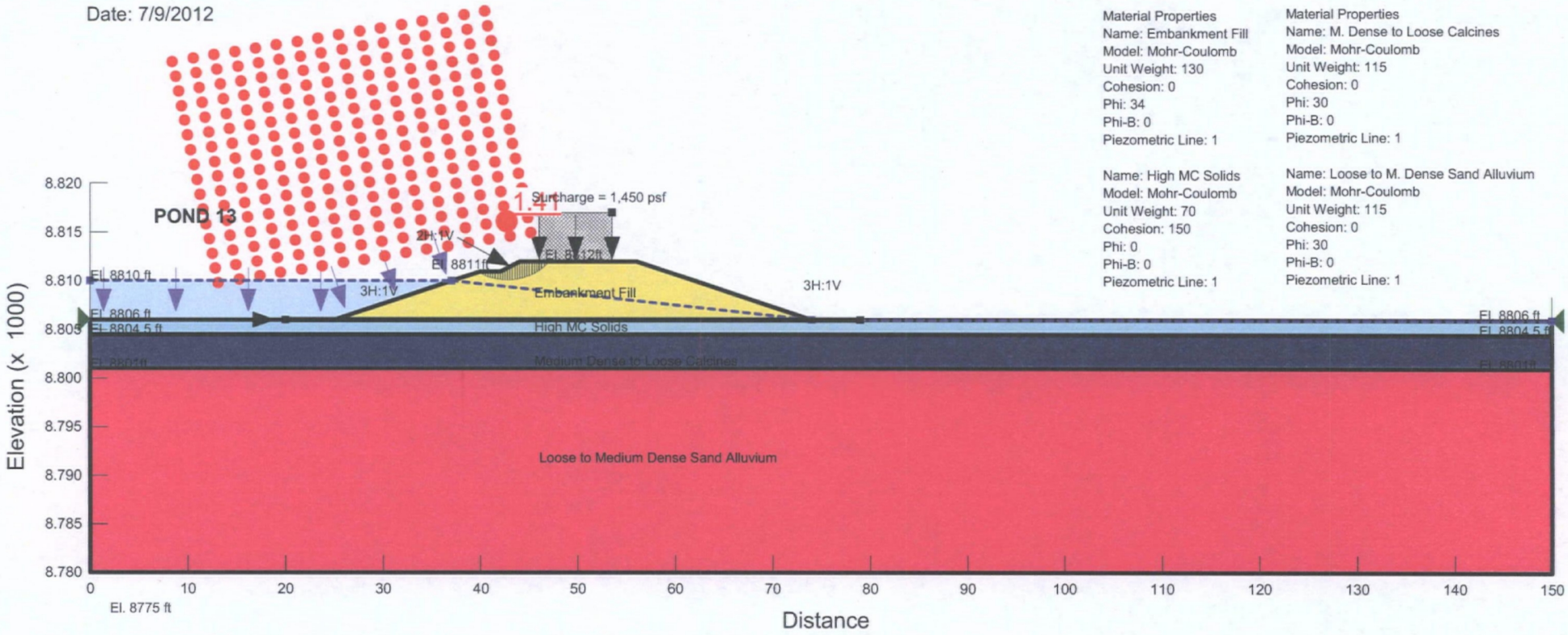
Name: High MC Solids
Model: Mohr-Coulomb
Unit Weight: 70
Cohesion: 150
Phi: 0
Phi-B: 0
Piezometric Line: 1

Material Properties
Name: M. Dense to Loose Calcines
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Name: Loose to M. Dense Sand Alluvium
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Title: RICO Pond 13 New Dike Stability
Comments: Pond 13
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/9/2012



Material Properties
Name: Embankment Fill
Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 34
Phi-B: 0
Piezometric Line: 1

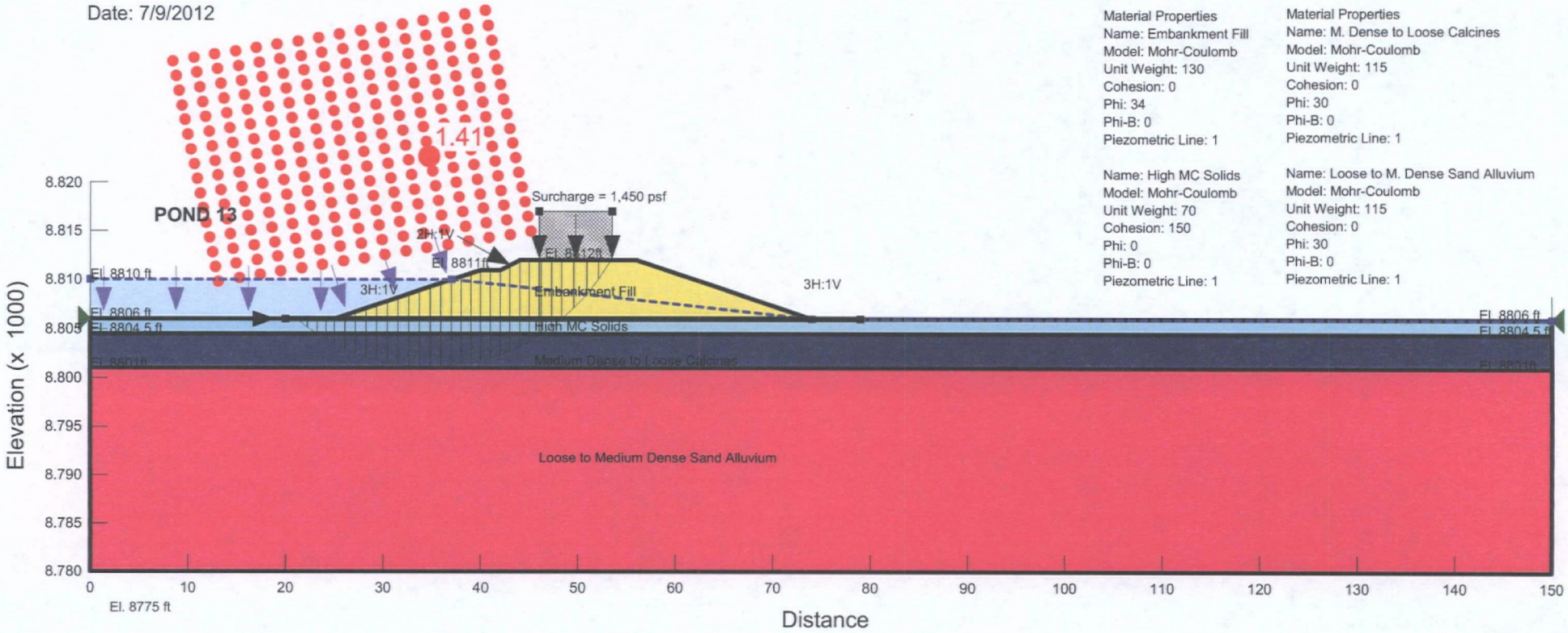
Material Properties
Name: M. Dense to Loose Calcines
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Name: High MC Solids
Model: Mohr-Coulomb
Unit Weight: 70
Cohesion: 150
Phi: 0
Phi-B: 0
Piezometric Line: 1

Name: Loose to M. Dense Sand Alluvium
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Title: RICO Pond 13 New Dike Stability
Comments: Pond 13
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/9/2012



Material Properties
Name: Embankment Fill
Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 34
Phi-B: 0
Piezometric Line: 1

Name: High MC Solids
Model: Mohr-Coulomb
Unit Weight: 70
Cohesion: 150
Phi: 0
Phi-B: 0
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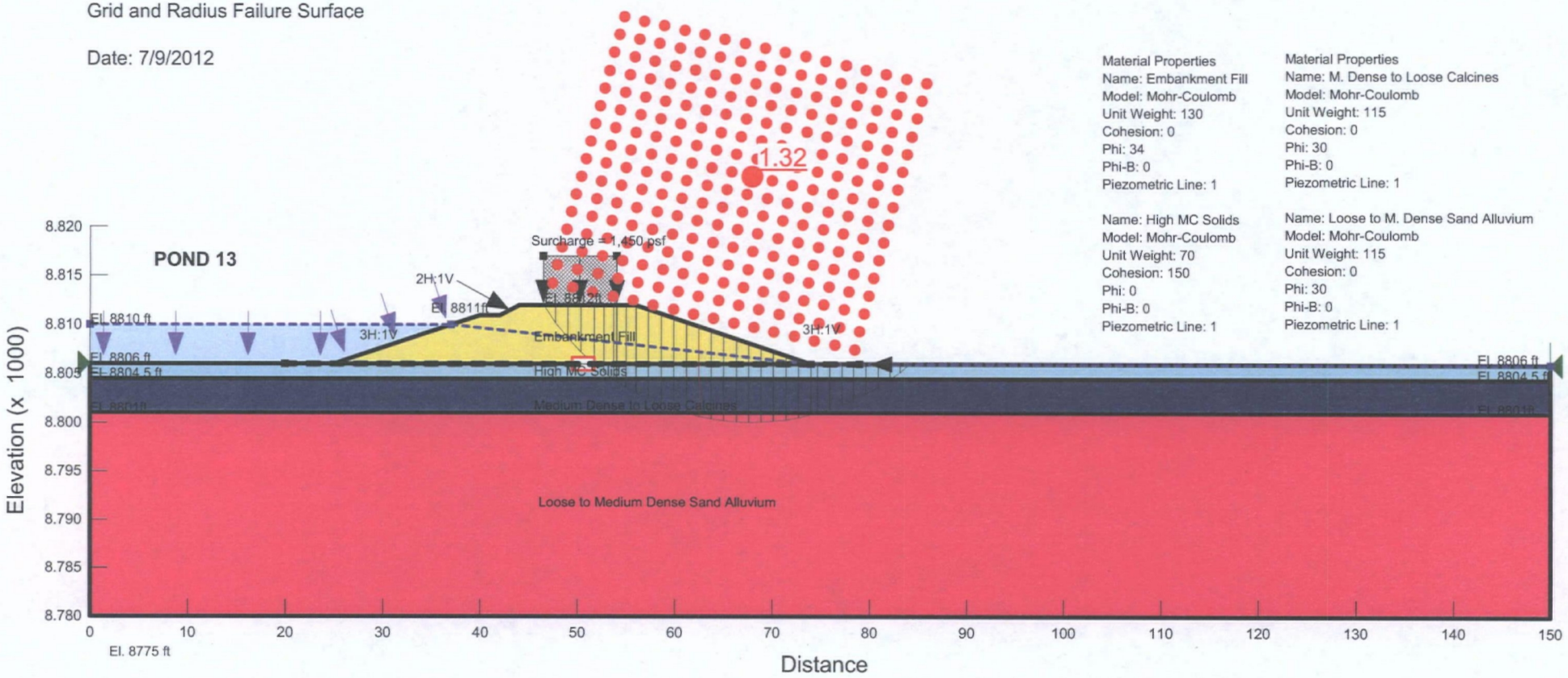
Title: RICO Pond 13 New Dike Stability
Comments: Pond 13
Method: Morgenstern-Price
Grid and Radius Failure Surface

Date: 7/9/2012



Material Properties
Name: Embankment Fill
Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 34
Phi-B: 0
Piezometric Line: 1

Material Properties
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Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

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Model: Mohr-Coulomb
Unit Weight: 70
Cohesion: 150
Phi: 0
Phi-B: 0
Piezometric Line: 1

Name: Loose to M. Dense Sand Alluvium
Model: Mohr-Coulomb
Unit Weight: 115
Cohesion: 0
Phi: 30
Phi-B: 0
Piezometric Line: 1

Embankment over soft subgrade ACJ
Rico St. Louis Ponds, Pond 13 Dike 7-Jul-12
Methodogy per: Engineering Use of Geotextiles, ARMY TM-5-818-8, 20 JUL 1995

Foundation			
Soil Friction, φ	0	Degrees	
Depth	5	feet	
Undrained Strength	150	psf	
Nc	5.14	Surface crust	
Nc	3.5	No Surface Crust	
qult	771	Surface crust	
qult	525	No Surface Crust	
Geotextile/Geogrid			
Required Tensile Strength	3000	lb/ft	(from slope stability)
Friction angle (emb/textile)	25	degrees	0.436332 radians
Cohesion (fdn/textile)	150	psf	
Embankment			
Unit Weight	130	pcf	
Friction Angle	30	degrees	0.52 radians
Crest Width	12	feet	
US Slope	3	:1	
DS Slope	3	:1	
Height	7	feet	
Dike Width	54	feet	
Cross Sectional Area	105	sf	
Applied Stress	910	psf	
Average applied stress	253	psf	(assumes geotextile acts as mat foundation)
FS, Bearing	2.1	No Crust	
Soft Foundation/Dike Depth Ratio	0.71	Values less than 2.0 indicate FS higher than indicated	
Minimum foundation cohesion to resist squeezing	42	psf	(assumes two flat plates)
FS	3.6		
Toe Squeeze			
Pp-Pa	347	psf	(greater than zero indicates no squeeze failure)
Geotextile Interface			
Active Pressure, Pa	1062	psf	
Resisting Pressure	4456	psf	
FS	4.2		(should be 2 or above)
Required Geotextile Properties			
Geotextile Splitting (5% strain)	1593	lb/ft	(1.5 FS)
Stability Analysis (5% strain)	3000	lb/ft	
Minimum Stregth (5% strain)	3000	lb/ft	
Minimum Ultimate Strength	6000	lb/ft	

Constants		
Pi		3.14
45	Degrees is	0.79 radians

Utilize two layers of Mirafi HP 570 or equivalent